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Reorganization of public courtyards by using the principles of greening space

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Abstract. At present, the issue of the architectural space development from the point of view of ecology and green architecture seems to be relevant. Life in the city involves the active use of public spaces and the closest to man is a yard space. The yard is a space for rest, sports and communication between residents. The sustainable development of such spaces has a favourable impact on the entire city. The analysis of the interaction of green spaces on the urban environment shows the importance of the development of the nature in the city. This problem can be solved by greening yard spaces. The article presents the classification of typologies of yard spaces. The yard in the neighbourhood allows considering urban public space as a platform for favorable impact on the resident. The article also presents universal principles of greening public spaces based on analysis of world experience. The formation of yard spaces with the application of green principles is aimed at the development of a comfortable urban environment. Changing the ecology of the city through reorganization of yard spaces contributes to the development of a socially, environmentally, psychologically healthy person.

Keywords: public yard, greening, public spaces, urban green space, spatial ecology, social-ecological processes.

1 Introduction

The relationship between nature and man has been observed for centuries. The consumption of natural resources and the process of urbanization are changing human attitudes towards nature. At the beginning of the twenty-first century, the trends of architectural space are aimed at the development and formation of new relations between man and nature. The study of the mutual relationship between the natural and urbanized environment has become particularly relevant. Urban space becomes man-made, negatively affecting humans. The evolution of the relationship between the city and nature leads to the search for new scientific and theoretical approaches to the formation of an ecological architectural space. The awareness of problems and the search for approaches encourages mankind to change the usual way of life and to apply more environmentally friendly approaches in different spheres, including architectural design.

The issue of research of interaction of natural and architectural environments was dealt with by ecologists, sociologists, urbanists, architects. Recreational spaces of the city are aimed at the development of a comfortable urban environment for man, with the possibility of approaching nature, its creation. Yard spaces present for the resident of the city an environment for recreation and contemplation of nature, for development of healthy lifestyle and games.

Strategies for the development of the urban environment involve the development of new modern approaches to improving the ecology of the city through innovative and creative strategies [1, 2]. As



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well as the development of the ecology of the city as an integrated socio-ecological study of urban systems [3] and the further development of biophilic and green urbanism, urban ecosystems [4, 5, 6].

Yard spaces stand out as «commonplace», used daily by humans several times. The yard for the resident appears to be a semblance of the gateway between the city and the apartment. From the point of view of urban environment development, the court solves typological, ecological, spatial, physical and technical issues. The yard space affects the quality of the environment, the quality of life of the residents of the city; testifies to the ecological, social and economic sustainability of the urban territory [7, 8, 9].

These solutions are possible using pro-environmental technologies [10], renewable energy sources and environmentally friendly materials [11, 12].

The recreational function of the court consists in socio-cultural formation of the neighbourhood environment, as well as socio-cultural ecology [13].

Greening is one of the most common ways to improve ecology [14], as well as beneficial impact on the development of cognitive development of children [15], positive impact on mood, motivation and energy [16], maintenance of psychological health and social interaction for older persons [17-20].

The introduction of green principles will reduce the anthropogenic impact of the environment on humans and create a harmonious green space and a comfortable environment. Yard areas will become more attractive and comfortable, providing a variety of use cases for humans.

2 Materials and methods

The materials of research are based on the theoretical works of Russian and European researchers, as well as using the materials of architectural projects. Research methods are based on a systematic approach. In the research process, the historical-architectural method was used to classify yard spaces. The method of comparative analysis of architectural projects was used to identify examples of greening yards. Methods of analogy and generalization were used at the stage of describing the universal principles of greening the architectural space. The idealization method was used to create descriptive and graphic models of applying the principles of greening for the reorganization of yard spaces.

3 Results

3.1 Classification of public spaces

The urban public space is not homogeneous and consists of an environment artificially created by man; the city includes natural elements, as well as joint creations of nature and man. All public spaces can be classified and applied to different principles of greening. Doctor of Architecture Gelfond A. proposed a classification of public spaces as spaces of social activity on various grounds [21]. One of the common characteristics is the division into organized, unorganized and transitive public spaces.

3.2 Definition of yard spaces

In architectural practice, there are several definitions of yard spaces. Initially, the etymology of the word yard is from Slavic «dvor» in the meaning of «house», «izba», «family together with its house» [22]. Also domestic space is the territory adjacent to the residential building and being in general use of the persons living in it, limited on perimeter to residential buildings, buildings, constructions or protections. Children's playgrounds, places for rest, car parking, green plantations and other public facilities are located on the yard territory for the benefit of persons living in the residential building to which it is adjacent. In other words, the yard is the inner plot of land located between the house buildings [23]. Yards are an integral part of the life of a citizen in which public social ties are formed.

Classification of domestic spaces. The development of open public spaces is carried out at different state levels and is noted as a priority development for the city. All public spaces exist in the city system. Based on the classification of O.V. Pachenkov, yard territories belong to the «ordinary public space», which is due to the daily use of this territory by a person [24].

3.3 Functional areas of yard spaces

It is possible to distinguish five main functional zones of the territories of yards:

1. Entrance zone. Part of the near-house areas adjacent to the entrances to residential buildings.
2. Parking zone. Part of the yard area intended for storage of motor vehicles.
3. Noisy recreation area. Part of the yard area where recreational grounds are located, designed for types of recreation with high noise characteristics.
4. Quiet recreation area. Part of the yard area where recreational grounds designed for recreation types with low noise characteristics are located. Such sites should be protected by the street-road network and by noisy recreation areas.
5. Economic zone. Part of the yard area intended for placement of maintenance elements – garbage collection sites [25, 26].

3.4. Author's classification of yard spaces

On the example of the territory of residential microdistrict built during the Soviet period, various types of public spaces have been dismantled. Yard areas refer to open public spaces. We can distinguish types of yard spaces in the territory, which are classified into four groups by type of surrounding development and nature of use by the population (figure 1a-d.):

Figure 1a: a courtyard combined with social facilities that serve the neighbourhood. Spatial organization is due to the combination of pedestrian and transport routes, which are formed taking into account the location of external and internal points of attraction. The biggest influence is the internal points of attraction - social objects. The main pedestrian path connects them, closing, and branches out along the shortest distance to the nearest external points of attraction. Secondary pedestrian paths lead to entrances to residential buildings.

Figure 1b: a closed, hidden courtyard from pedestrians, completely surrounded by houses. It serves as recreational space for residents. The spatial organization of this type of territory is formed by short pedestrian paths, which link different functional zones inside the complex to each other, but do not form through pedestrian connections within the boundaries of the whole yard territory, as it is used by residents living in houses, forming the boundaries of the territory.

Figure 1c: public-residential yard combines two functions. The space is divided between the residents of the house and the residents of the area. The space used by all residents of the area is square. This yard space is formed by the existing planning structure of the entire neighbourhood. The boundary between the square (public space) and the courtyard (private territory for residents) itself is the fence. The main pedestrian paths are through passages between residential buildings and inside the square. They lead to: public transport stops, pedestrian crossings, social infrastructure facilities in neighboring yard areas, as well as to service facilities and public buildings. Secondary pedestrian paths run along residential buildings and connect the entrance areas to the residential building with the main pedestrian paths or directly with the street, including intersecting with the main ones.

Figure 1d: a public courtyard accessible to all is surrounded by a house on one side. The existing planning structure of the quarters. A characteristic feature of the yard structure for this type is the front formed by the building. Residential groups that clearly divide yard territory into more private and more public spaces. Private spaces are located inside residential groups; public spaces are located between other residential groups. The main pedestrian paths pass through and along public spaces.

The peculiarity of the soviet microdistrict is the absence of closed courtyard spaces. Pedestrian routes connect all territories and spaces, permeating the entire microdistrict, creating a holistic pedestrian route, being historically established through pedestrian walkways through the quarter. Yard areas are an integral part of the district, both public and private, as they satisfy the needs of residents of the house and the needs of residents of the entire district.

Another feature of the soviet microdistrict is the number of green spaces. There are 4 important elements for the success of public space: water, wind, trees and sunlight – elements without which a person will not feel comfortable in public places. Plants are one of the greatest «technologies» created

by nature. They create a cozy and comfortable space for a person, and also purify the air, increasing the level of ecology of the territory [27].

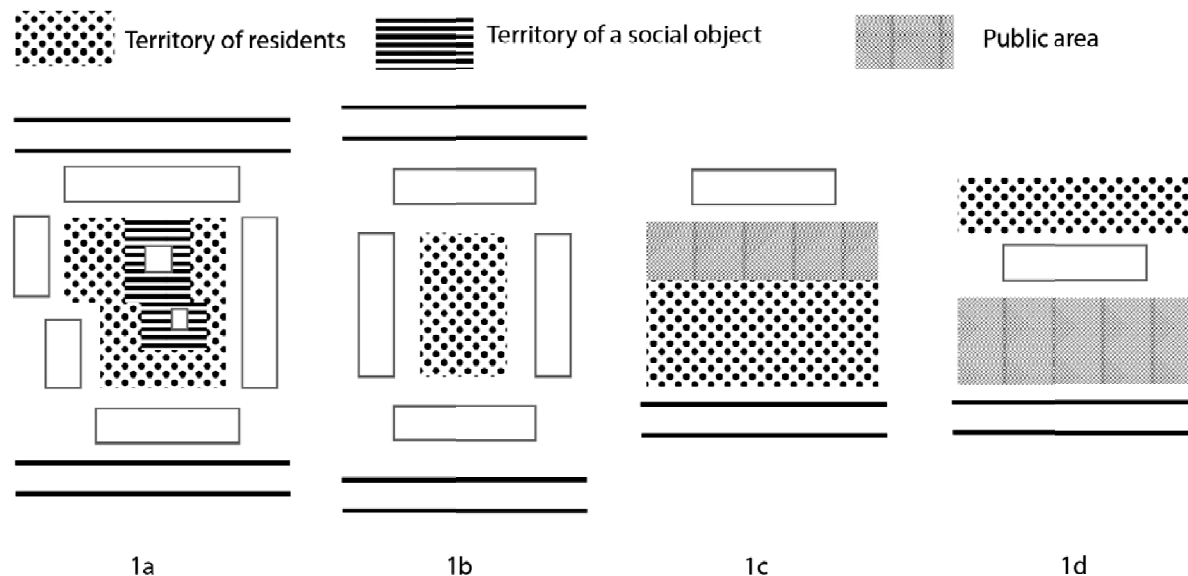


Figure 1 a-d. Classification of courtyard spaces by type of surrounding buildings and nature of use by the population.

The modern courtyard is a multifunctional territory intended for integrated employment of the population [28]. Nowadays, courtyards often become hostile anthropogenic environments due to various factors [29]. This trend is characteristic not only for overpopulated central cities, but also for distant ones.

3.5 Definition of greening

Even at the first stages of society formation there appeared techniques of formation of environmentally friendly architectural environment. The accumulation of these techniques led to the emergence of a new type of architecture - eco-architecture – an architecture that meets the principles of greening.

The term «greening» originated in the 19th century. It was extensively used in urban planning. At that time it appeared in concepts of «garden city», linear city, etc. This has acquired its direction in the design of cities - urban planning ecology. Now, this term is spread across many disciplines: economics, management, education and architecture. In each direction it is embedded in its meaning and it is revealed in different ways. In architecture, its disclosure consists in environmental protection technology, which is based on the application of green standards at the stage of project development, construction and operation. Greening existing yards is their reconstruction aimed at improving the environmental friendliness of the yard, and the environment. More precisely, the yard becomes protected from external negative factors, carries eco-oriented functions, uses environmentally friendly materials and technologies.

Examples of green yards include:

- Val furre district in Mant la Jolie, in France. The feature of the district is that initially the yard was given only for parking, after reconstruction all parking spaces were taken out outside the yard, and the yard itself was planted with trees and created an interesting landscape, which was there before everything was equalized. The feature of the court was how it transformed everything around it and changed the atmosphere. This is an example of creating a natural urban environment.

- Ostheim district in Cologne, Germany. The feature of this area is that the complex of houses forms a strange elongated and curved shape of yards, which is difficult to use in a standard approach

to design. Reconstruction of this yard showed that in any form it was possible to properly fit and arrange all necessary functions. Modern sports and children's playgrounds are also exciting.

- Residential area of St Andrews in London, UK. London is characterized by sufficiently dense development, which creates a negative impact. During the reconstruction of this area there was a task, to minimize this influence, by creating well-equipped green yards with semi-closed quiet spaces. The needs of people to be able to hide from the fuss and quietly spend time were at first place. This was achieved. This example shows that in dense construction, it is possible to create a comfortable environment for residents and take into account their interests.

- Inner courtyard of the house in Kristianshavn district, in Copenhagen, in Denmark. This is a very interesting example of greening a small and on all sides of a closed yard. In the center of the yard one large flowerbed was created, but it was made in very interesting shape, which created in itself recesses and there were laid small secluded spaces. The flowerbed itself rose above the asphalt and consisted of flowers, shrubs and trees. Also on the border a bike park and pavilion for storage of things were created.

As practice and various studies have shown, the care of the yard, if carried out directly by the inhabitants, has a beneficial effect both on their physical condition and on their internal condition. Care and responsibility change people's consciousness. The attitude towards one's own court is changing, which means that over time it can change to the whole city. It also creates a beneficial environment for the upbringing of children and their ecological identity. Also, well-equipped yards affect the quality of life in the surrounding development. Data have been found that people living with views of green areas are easier to tolerate diseases, feel less tired and are less susceptible to stress [16].

3.6 Principles of greening

Based on the examples and the study, we can formulate universal principles of greening, for the reorganization of existing courtyards (figure 2a-e):

Figure 2a shows the principle of maximum use of geographical position. It consists in the fact that the relief laid by nature should not be changed, but it is worth using and extracting all the possible advantages (direction of roads and drains, placement of small architectural forms, possibly water bodies, etc.)

Figure 2b shows the principle of increasing the role of the green «component» in domestic spaces. It consists in the proper placement of trees (as a buffer zone, or intermediate), the creation of installations using plants, the use of plants in the surrounding buildings - landscaped balconies, facades, etc. It is also possible to create eco-friendly parking lots or a city garden.

Figure 2c shows the principle of correct zoning. Since all people have different needs, they need to be correctly positioned relative to each other. Whatever the path is not close to the playground, but it is in its direction next to the area for walking dogs. Social ecology, its consciousness and comfort depend on it.

Figure 2d shows the principle of popularization of ecology or ekologizatsiya consciousness. It consists in creating a connection of courtyard functions with an eco-concept. In the presence of additional social facilities, their functions must meet environmental requirements. Small architectural forms should be assembled from environmental materials. And a demonstration of various eco-rational, resource-saving technologies as a means of popularization is also welcome.

Figure 2e shows the principle of autonomy, which will attract investors for investments, as well as residents to participate in the life of the common yard, taking care of it (the independence of the yard from the company management or HOA). Responsibility passes to the users themselves.

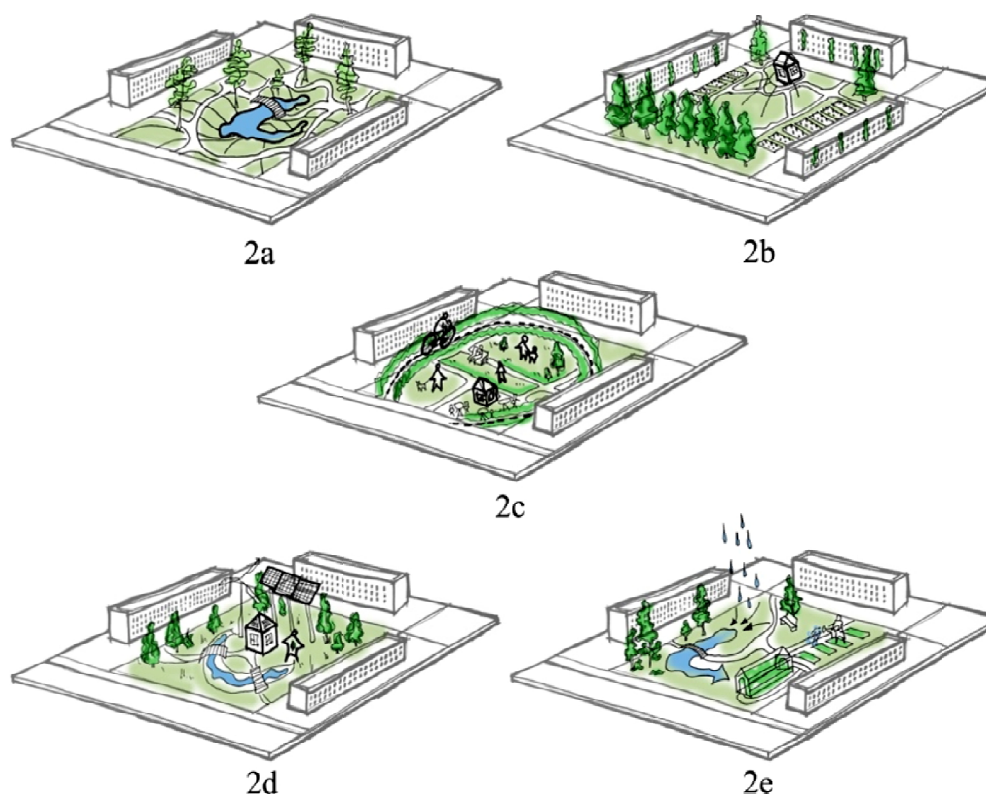


Figure 2a-e. Principles of greening.

3.7 Application of greening principles to yard spaces

A certain set of green principles can be applied to each type of yard:

To a court of type «1a» it is possible to apply a whole number of principles of greening. Principles 2b, 2d and 2e will be particularly effective through the availability of social facilities.

2b – Placement of green areas dividing the yard into small areas, creation of a buffer from greening, creation of a connection of greening with social objects – cafes, shop, etc.

2d – Assigning to social objects of ecological friendliness due to: local materials, compliance with scale, use of natural relief. As well as following the IVF trend.

2e – The part of the territory belonging to social objects can contain more expensive and natural components, both for visitors and residents (children's playgrounds, built quiet tame places, etc.) as well as the possibility of better quality of their content.

A yard of type «1b» will best reveal the essence of principle 2b, especially the possibility of creating an urban garden in it.

2b – Since the yard is closed, there is no need for a high buffer zone. It is enough to use shrubs. Part of the yard can be given to urban gardens, where interested residents will be able to grow various vegetables as a hobby, or demonstrate work to children.

In the yard of type «1c», to a greater extent will find application principle 2a, in that in case of mixed zoning, it is important to arrange and identify each zone accordingly.

2a – In the mixed yard there are nuances that need to be taken into account in zoning. For example, areas of society and residents should not displace each other. And there should also be a uniform distribution of points of attraction on such yards. With the accumulation of people in one place, the possibility of conflicts increases, so the division of territory into zones by functions and the avoidance of some overlaps is the key to the successful transformation of the yard.

The yard of type «1d», in itself equally combines the use of all principles, as divided into 2 unrelated in function and ownership, and each reflects different principles of greening.

4 Discussions

The authors propose the application of the principles of greening yard spaces. In greening any yard, the algorithm of actions is as follows: it is necessary to assign it to a certain type (1a-d) and further choose from suitable and most reflected in it the proposed principles. For each type of yards the scenario of space is suitable, allowing to solve issues of topical development of the territory with application of principles of greening.

In general, many studies prove the importance of forming an architectural space using an ecological approach to design. The authors propose the reorganization of existing courtyards using the principles of greening. In the implementation of such decisions, the importance is given to applied research of the using of green plants and ecological materials [11, 14]. Many studies prove a positive impact on human health, its physiological, social and psychological characteristics [17, 19]. Another specific feature in research of that area can undoubtedly be considered the importance of environmental education and the development of environmental relations [16]. Local and global studies of this topic are aimed at creating the environmental friendliness of the architectural space in which a person feels closeness to the natural environment.

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