Formation of atrium spaces in the urban environment

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Abstract. This article addresses characteristics of interactions between an atrium space and the urban environment. Renewal and transformation of urban areas over time become urgent problems which solution affects further development and preservation of the uniqueness of environment. The urban environment serves as a basis for a new spatial structure – an atrium space – formed as a centre of social activity. It contributes to the improvement of the level of comfort of the existing urban built-up area by including additional elements of the environment, new functional centres and communication linkages in the urban interior. The formation of an atrium space involves the development of a design solution based on the proposed principles of composition and planning, including "Concentration", "Combination", "Integration" and the "City Hall" principles. In the high-density urban environment, it is advisable to apply the "New-in-the-Old" and "New Inside" principles. The use of atrium spaces in the urban environment opens up new opportunities for existing building system and its components without compromising buildings’ uniqueness.

1. Introduction

Over time, there is a growing need for local or global transformations of the urban space that will solve the problems of harmonization of the environment. The problem of the renewal of a functional and aesthetic components of historical city centres becomes especially critical.

The development and application of the principles of composition and planning will contribute to the high-quality transformation of the spatial urban environment. In the current state of urban development, the integration of an atrium space as a new component is a way to form additional communication linkages and aesthetic features. Its integration in the existing urban environment stimulates the development of new functional areas, with are linked with each other through certain processes.

The existing urban environment forms the basis for an atrium space created as an active public area promoting the development of multidisciplinary components in the structure of urban built-up areas. Spaces inside building blocks, courtyards, major and minor streets can be renewed this way, to provide new development incentives and land use options. An atrium space combines branched parts of the urban area and forms a special object-spatial environment. Due to its connection with the surrounding environment it combines both interior and exterior properties.
2. Identification of the problem

Modern architects face two main challenges related to the urban environment. First is the preservation of an existing urban built-up area with its authenticity, originality and established traditions. Second is the introduction of new functions and three-dimensional components into the existing built-up area.

To highlight a certain fragment of the existing architectural environment, the following parameters can be defined as typological units: boundaries of the area planning, compositional characteristics, habitual life of residents and sustainable social processes, and the identification of a place for public [1, p. 112].

Due to interventions affecting only interior or intermediate spaces, functional renewal of the urban environment does not disturb a usual appearance of historically formed streets and at the same time contributes to the expansion of human activities. That is, the development goes "from inside out", forming new spatial elements [2, p. 294]. Very often those fragments of the urban environment that are located inside building blocks, are left behind. However, after all, those possess a great potential for further development of the environment, expanding its functional and compositional boundaries. In addition, a high occupancy of cities should be compensated by a sufficient number and quality of buffer zones, especially in the central parts of the cities forming centres of business, administrative and economic activities of the city. It is expedient to place functional combinations in such zones to meet various needs of the public, and the inclusion of an atrium space can connect such zones with each other. An atrium space in urban environment promotes communication between people, and therefore should be made as comfortable as possible. It forms some kind of a community centre, which concentrates a set of functions. The level of comfort is primarily defined by a correct selection of the key criteria, which include: - a space created for public communication; - a developed set of functions; - an artistic expressiveness and meaningfulness; - rational planning and zoning of the area where the atrium space is located; - taking into account the characteristics serving for a psychological comfort; - working with the local community to identify people's preferences, priorities and needs; - solving local and city-wide problems of the improvement and development of the urban environment.

Observing changes of the urban environment, at a certain stage one may notice, how mobile and flexible it is in relation to the modern requirements of the society. A comprehensive approach to the problem of renewal of the urban environment leads to a high-quality result, which is preceded by the following stages of work: - a comprehensive research investigation; - a development of concepts based on the key conclusions of the previous investigation; - design proposals for a three-dimensional solution of an atrium space; - public discussions on the project; - financial investments to contribute to the full implementation of the project.

Therefore, it should be noted that the process of including new components in the urban environment should be delicate and well balanced. In particular, the formation of an atrium space provides a possibility of combining the urban space with the surrounding built-up area.

The balance between open spaces and the existing built-up area can be achieved with a combination of different styles separated by decades or centuries of construction. The new building should be considered as a part of the historical centre of the city, which is organically included in it without using stylistic patterns of the past [3, p. 186].

Urban public spaces must have their own identity and to combine in different ways. An identity can be defined: dynamic meaning of a site, landscape and city landscape elements, sites with a specific functional filling etc [4, p. 106]. Cites today – are monotone patterns of static elements which are missing flexibility and elasticity, visual and fiscal features which are concordant with functions and technologies. Our cities must change according to their social and economic status, get rid of "temporality" flaws in their worst manifestations [5].

Atrium spaces' applying in cities with big population and acute shortage of public spaces are especially important. In this case an atrium space can combine functions of a public zone as part of urban space and serve as a transport hub [6]. The urban environment is assumed by an observer to include an area that fills in the space between buildings and structures. Some types of such areas are assumed as independent spatial units (squares, parks, public gardens, etc.), others as an integral part of
the urban space (roads and sidewalks). The formation of an atrium space is aimed at balancing the overall appearance of the environment, i.e. at combining individual spatial components into a single compositional framework. Thus, it transforms certain areas of the urban environment, changing it at different levels, including a complete or partial restructuring. In this context, an atrium space allows to achieve a balance between the functional and artistic-compositional aspects of individual buildings, the natural component and the various spatial urban elements. An atrium space is an integral unit which creates a type of the environment for the development of various forms of public life which provide new ways of spatial organization of urban centres and result from organization of an atrium.

3. Result
At this stage, a critical task is to develop fundamental solutions aimed at integration of an atrium and urban spaces. Therefore, in this context, an atrium is considered as a key connecting element of the environment. It is also an object that plays a role of a buffering spatial component of the urban environment, capable of uniting parts into a single whole forming a unique object-spatial environment.

Forming atrium spaces in the urban environment requires application of a number of principles of composition and planning, which form the background for architectural and urban planning decisions, those include concentration, combination, integration, and the "City Hall" principles. The use of one or another principle in the investigation of an object of the urban environment leads to formation of some kind of an initial template or scenario for further work. The development of principles for integration of different urban objects should contribute to the effectiveness of project activities and lead to the unity of separate objects. An atrium space is a new unit to the existing urban built-up area, so it should be noted that it not only combines the ongoing processes in the formed environment, but also renews functional indicators of such environment. [7].

The Concentration Principle provides for the enrichment of the object-spatial environment within a certain local zone of the urban built-up area. It is characterized by the compaction of three-dimensional and planning structures of the space, bringing in order and achieving functional saturation of narrow interior spaces of urban blocks and completeness of the three-dimensional-spatial solution (Figure 1).

![Figure 1. The Concentration Principle](image)

This principle provides for:
- concentration of functions (introduction of new objects and combination of the existing ones through their organization within an integral spatial planning solution);
- organization of a closed-type atrium space (a space limited by existing buildings, most commonly – a small courtyard, the space of which is formed by several buildings);
- increasing the level of social activity (using the area as a common public space, stimulating social communications);
- improvement of an atrium space as a part of the urban interior (placement of street furniture and installations for a smooth transition from the outdoor environment to the interior, aesthetic appeal).
The Combination Principle is used to combine two or more local spaces. It involves a sequential transition from one object to another and is used in cases where it is necessary to combine discrete areas of the urban environment into a single system (Figure 2). This principle provides for:

- organization of a system of spaces that are linked with each other (a combination of three-dimensional and planning solutions of one object with another, a common composition of ideas);
- a multilevel organization of communication zones (use of horizontal and vertical communications for a seamless transition);
- consolidation of branched sections of the urban space (complex solution of an atrium space for a certain area, usually within one block);
- structural reorganization of space (arrangement of additional volume of space, complete or partial reconstruction of objects of the built-up area due to the inclusion of an atrium space);
- functional saturation (a set of functional points that support social activity in a particular environment);
- site improvement (street furniture, installations, landscaping, all of which are located at different levels and complement the environment);
- organization of additional pedestrian connections (the multilevel organization of an atrium space allows the distribution of pedestrian zones and inclusion of additional communication nodes in the space).

The Integration Principle establishes a connection between different types of the space. It provides for adaptation of new spatial structures to the existing urban environment and allows renewal of the urban environment without violating its integrity, characterizes actions aimed at the recovery of the environment and filling it with new qualities (Figure 3).
This principle provides:
- formation of an atrium space inside building blocks (use of an intra-block space as a part of the urban interior);
- providing an active public space (inclusion of various social functions, organization of a multi-purpose place, mobility of the space);
  - expansion of spatial features of the existing built-up area (integration of an atrium space makes it possible to expand the useful area and structural volumes of public buildings and zones);
  - organization of a recreational area (with an atrium space green recreational zones accessible to all residents can be organized within the built-up area);
  - a multipurpose use of an atrium space (as a public centre with a diverse set of functional areas, such as a trading zone, food court, exhibition space, recreational area, etc. It is also appropriate to arrange office spaces there).

The «City Hall» Principle provides for the placement of socially active space within the city structure. The term "City Hall" refers to the space, in which a functional node of a citywide importance needs to be organized. This principle should be applied in cases where there is a need not only to combine the surrounding built-up area with a new function, but also to organize interconnections of pedestrian and transport routes (Figure 4).

![Figure 4. The «City Hall» Principle](image)

This principle provides for:
- an efficient use of yard spaces within blocks (rational space planning, improvement of aesthetic features and the comfort in general);
- a place for organizing public events (an atrium space filled with mobile elements, which can be adapted to different tasks);
- organization of a functional node (object filling, which is subject to a clear functional scenario, possible combination of an atrium space with public transport);
- arrangement of a compositional core (creation of a structure forming a compositional basis of the surrounding built-up area and contributing to the creation of an integral, harmonious and artistically expressive solution);
- a recreational area within a block (landscaping, creation of play areas and recreation zones).

«The need for an organic combination of the interior with the nature and protrusion of the interior to the external environment gives rise to the development of a method destroying the boundaries between the external and internal space» [8, p. 286]. Therefore, the construction of a composite model, which is saturated during the development of the project, helps to achieve a balanced order of the entire three-dimensional structure [9]. When an atrium is created in the historic centre of the city and the dense built-up area, it is also advisable to apply the «New-in-the-Old» and «New Inside» principles [10].

The «New-in-the-Old» Principle is aimed at expanding the functionality of the existing built-up area and renewal of its quality characteristics. This principle is based on placing the internal space within the established built-up area of the city (Figure 5). The principle provides for:
- a creation of an integral composition between the old and the new architecture (following compositional rules during formation of atrium spaces in the existing built-up area);

![Figure 5. The «New-in-the-Old» Principle](image1)

- an introduction of spatial structures (adding new elements to the existing built-up area, in particular, spatial expansion of historic city centres);
  - a functional expansion (introduction of new functions that stimulate intensification of activities in obsolete urban spaces);
  - a compaction of the spatial planning structure (obtaining additional areas for the surrounding built-up area or individual buildings);
  - improving the quality of the environment (the environment is complemented by new elements of urban design, creating recreational areas with outdoor furniture, architectural installations and art objects).

The «New Inside» Principle contributes to creation of a renewed environment without violating the integrity of the existing one. The application of this principle to the creation of an atrium space allows to expand spatial and functional capabilities of a dense urban built-up area (Figure 6). The principle provides for:

![Figure 6. The «New Inside» Principle](image2)

- obtaining new qualitative characteristics of the space (improving the comfort of the urban environment in a dense built-up area, setting up and arranging space within urban blocks);
  - establishing a single planning structure for the existing and new objects (thorough a detailed study and analysis of the existing built-up area to obtain a high-quality design solution for a specific area of the city);
  - expanding spatial capabilities of the urban built-up area (inclusion of an atrium space as a new spatial component possessing a certain set of characteristics);
- integration or branching of functions (formation of an atrium space provides a possibility of functional distribution within a dense urban built-up area).

Each principle should be appropriate to the specific situation, i.e. it should ensure proper functioning of the environment, support socio-cultural processes, provide compositional integrity and promote economic development.

4. Conclusion
Preserving unique historical features of city centres is a task of a top priority in the renewal of the urban environment that includes searching for appropriate architectural solutions and the discovery of new opportunities for urban areas and objects without compromising their uniqueness.

Using an atrium space for the renewal of the urban environment allows the creation of additional zones of public attraction in the existing urban structure. The urban interior formed with the creation of an atrium space, becomes an object of public use. The design process involves solving of urban, architectural, artistic and social problems, since the existing urban built-up area is renewed with the inclusion of new elements.

It is always necessary to analyse different options and apply those principles that are the most relevant and rational for a particular situation. An architectural model of the urban environment exists, first of all, in a static form which makes it possible to include both active and passive components. The modern urban environment has to provide a high level of comfort and the inclusion of an atrium space there should in addition create centres for the development of a public life.

Urban environment transformation using atrium space forms an updated look of the building. In relation to existing urban environment, atrium space is a new architectural unit that integrates into a street space, that is a linear type of space, and a courtyard is an accentuated area between architectural objects. In other words, what we have as a starting point for urban development reorganization of itself. An atrium space design in existing urban environment involves extensive analysis and careful study of a specific situation. After all, thanks to a comprehensive approach, it is possible to conduct quality research and effective atrium space adaptation into urban environment.

References

[1] Timokhin V O, Shebek N M, Malik T V ect. 2010 Basics of architectural environment design (Kyiv: Osnova) p 400
[2] Gutnov A E 1985 World of Architecture: The Language of Architecture (Moscow: Molodaya Gvardiya) p 351
[3] Walter Gropius 1971 Scope of total architecture (Moscow: Iskusstvo) p 287
[4] Carmona M, Tiesdell S 2007 Urban Design Reader (Architectural Press is an imprint of Elsevier) p 375
[5] Maki F 1964 Investigation in collective form (St. Louis, School of Architecture, Washington University) p 87
[6] Charlie Q L, Xue Luming Ma and Ka Chuen Hui 2012 Indoor ‘Public’ Space: A study of atria in mass transit railway (MTR) complexes of Hong Kong URBAN DESIGN International 17 (2) 87–105
[7] Vakhnichenko O V 2019 Compositional and planning principles of formation of atrium spaces in the conditions of urban environment revitalization (Kharkiv: Kharkiv National University of Civil Engineering and Architecture) p 195
[8] Novikova E B 1991 Public buildings interior: Artistic concerns (Moscow: Strojizdat) p 368
[9] Solobay P A 2001 Structurally-functional and composition modeling of educational complexes (on University example) (Kharkiv: Kharkiv State Technical University of Construction and Architecture) p 18
[10] Solobay P A 2008 Fundamentals and principles of reconstruction of the architectural environment of universities Visnik Kharkivskoi derzhavnoyi akademiyi dizajnu i mistecztv. Mistecztoznawstvo. Arkhitektura 1 p 114-121