The Urban Quanta: Locality and Marginality in the City

LORA DIKOVA
Miami University

Figure 1: The Urban Quanta - Spacetimes of Sofia

THE QUANTIFICATION OF THE CITY

The Greek urban planner and architect Konstantinos Doxiades believed that the cities would eventually become a single mega-structure he called Ecumenopolis – the city of the future.[1] Globalization nowadays is indispensible part of our lives, invading our cultures through the rapid developments in science and technology. Would globalization, however, erase the memory of place and space? Will it destroy the delicate fragments of cultural peculiarities our cities possess? Would all cities eventually begin to look alike as a result from the unification of globalization?

A major prerequisite for the outlook of our cities lies in the methodology of urban planning. Different planners have come so far with various approaches toward the city and its complex sub-structures. The patterns of Christopher Alexander[2], for example, began to account for the fluctuating and interconnected activities, proliferating in our spaces. On the other hand, Jane Jacobs[3] emphasized that the clear categorizing, such as the urban zoning methodology, could bring an unsatisfactory outcome, rather than the expected optimization of the city structure.

Today the necessity to cope with the processes of globalization, the issues of sustainability, and the advances in technology raises new questions which the utopian model of the "Radiant City of Le Corbusier"[4] cannot solve.

The micro and macro categories became more and more inseparable due to the accruing complexity of cultural, economical, and technological processes. Sub-structures of the city, such as satellite cities, outgrow their initial purpose and evolve to make the urban tissue more complicated and interdependent. Thus the scale factor in urban planning changes rapidly, and we could no longer utilize clear demarcation of locality and marginality to serve zoning, communication, infrastructure, etc. So how do we cope with the elusive notion of what is local and what is not? How do we bring micro and macro infrastructures together with their semiotic impact on social processes?

To consider these questions and to form particular urban approaches, this paper investigates possible interdisciplinary methodologies of analyzing complex systems. In particular it explores the methodological connection between design, considered as urban planning and architecture, and String theory,

taken as a framework from contemporary physics. However, unlike some previous approaches to relate urban planning and design to scientific theories, this study examines the possibilities for indirect formation of a design methodology, later referred to in this paper as The Weak Formation. For example, while in his study Ben Hamouche[5] refers to applying directly chaos theory to explain the complexity of the Muslim settlements, this investigation considers String theory as a source for possible frameworks for creating autonomous design approaches, subject to their own design particularities.

String theory's framework provides tools for interpretation of dynamic spatial processes by means of creating patterns, or dynamic algorithms, of interactions. In physics, the theory suggests patterns of brand new extended basic particles, called strings, whose fluctuations result in the already known to classical physics typologies of particles.[6] In urban planning and design, this methodology of zooming in and out reversibly, from micro to macro structures and vice versa provides appropriate algorithms for dealing with the changing urban scale factor, mentioned above. Moreover, String theory uses the concept of n-dimensionality with respect to mathematical necessity, while in urban planning and design n-dimensionality is used to deal with complex data about numerous variables, such as social, technological, cultural, infrastructural, etc.

Thus the urban units and their activities are considered not through the lens of being either local or marginal, in terms of infrastructure, zoning, communication, etc., but by being mutually dependent on a complex matrix of urban forces. Therefore, the demarcation between a building structure, for example, a house, and an urban structure, for example, a quarter, is substituted by the very forces of activities that happen spatially, economically, socially, technically, culturally, etc. Moreover, the pattern of these forces links the micro and macro scale by means of its own quantification.

To test such an urban quantification of scale, this study uses a particular place and time to experiment with local and marginal structures in discrete manner.

THE WEAK FORMATION

"The Urban Quanta" is a design project developed by exploring interdisciplinary design methodologies which use informational patterns from contemporary physics, in particular String theory.

The design process included investigating separate fragments from String theory's framework which presented possibilities for design applications. Thus during the research design work, concepts of discrete movement, n-dimensionality, topology, and related topics were examined for their possible applications in art, design, and science. The analysis of the case studies and the design experiments revealed that all chosen fragments from String theory's framework could be used in the design process as independent design catalysts. Their applications opened multiple possibilities such as providing tools for creating versatile morphologies or forming abstract connections between design elements.

In the next stage of the design investigation particular methodologies from String theory's framework were analyzed. The main objective was to explore different ways of framing the major logical chains among the theoretical events in String theory. Later, one of these possible logical chains was analyzed in respect to the design process. As a result from the analysis, a relative logical chain of design objectives was framed. The project "The Urban Quanta" was produced by following this logical chain of objectives, where each objective corresponds to a set of frameworks in String theory.

Thus String theory was used not as a directly applied scientific model, but as an indirect tool for producing spatial and dynamic connections between design elements. Analyzed further as a coherent methodology, String theory was used in design as a possible mode for producing chain of particular logical events. This approach allowed for the necessary theoretical demarcation between the scientific goals of String theory and the design objectives of urban planning and architecture. Taken as sets of logical connections between analogical structures, String theory provided a very specific and unique set of rules that were applied as connectors between the design stages, while the very design structures within these stages underwent only architectural iterations.

In short, the design objective to create a historical museum in Sofia relates to the main objective of the scientists to bring the theories of Quantum Mechanics and General Relativity together in a The-

ory of Everything. Any theoretical details after that starting point unfold independently for each field; in architecture as design stages, and in physics as scientific stages. It is only the logical connections between these theoretical stages that correlate, and form the particular cross-disciplinary link between the areas of physics and design.

I call this interdisciplinary relation between String theory and design The Weak Formation because, on one hand, there are crossing points in the methodology between the disciplines, and on the other, both fields maintain their sovereignty in their own development.

THE URBAN QUANTA

The project "The Urban Quanta" is a design for a history museum, encompassing the cultural, historical, and urban heritage of the city of Sofia, the capital of Bulgaria.

Preceded by several urban studies at different locations in the city, "The Urban Quanta" forms an urban event, which unfolds in the urban tissue of Sofia as series of discrete sub-events, all of which deal with historical presence or absence in the existing urban form. Each event disintegrates into smaller urban entities. The challenge in this approach is to create an ambiguous difference between urban and local forms, to blend together the infrastructural and semiotic scale of micro and macro units. The design questions which architectural elements belong to the city, being strictly urban, and which belong to the existing buildings, being local.

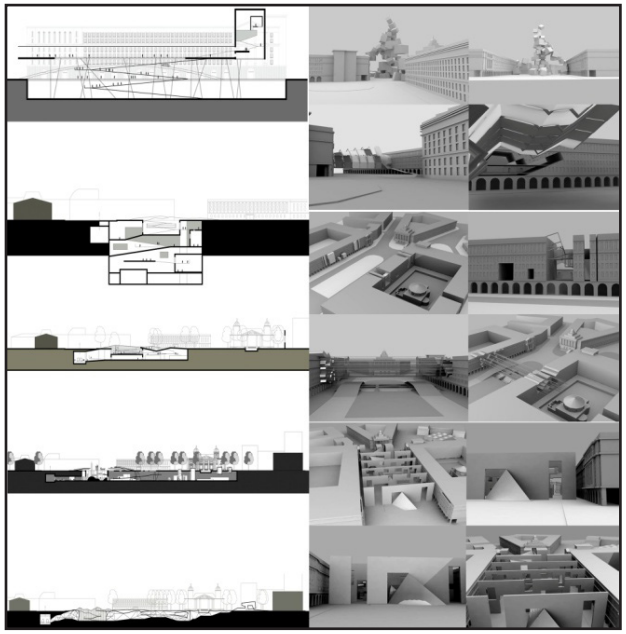

Figure 2: The Urban Quanta - Urban Possibilities

For the purpose of spanning the difference in scale, from urban to local, a basic element of transformation is introduced – the Urban Hypersurface. In String theory physicists propose extended particles, called strings, in order to embrace both, the point-like and wave-like behavior of the particles. The geometry and topology of the so-called strings allow for this transformation to take place without losing particular properties, belonging to any of the above types of particle behaviors. In the proposed design for Sofia, the Urban Hypersurface plays a role similar to that of the strings in physics. A two-dimensional surface is a mathematical two-dimensional object, which establishes reference to three-dimensional geometry, if considered as a boundary or an intersection between three-dimensional spaces. Thus the surface, being two-dimensional object, already provides possibilities for higher dimensionality. The hypersurface, on the other hand, is a surface of multiple dimensions. These dimensions could be mathematical, as in the case of String theory, or could be assigned to different types of variables they define on urban level. It is important to note that n-dimensionality in String theory is raised as a requirement due to purely mathematical reasons. The necessity to input extra information about the typologies and behavior of the particles is the major reason why scientists introduce more than three spatial dimensions. Therefore, n-dimensionality is merely a tool

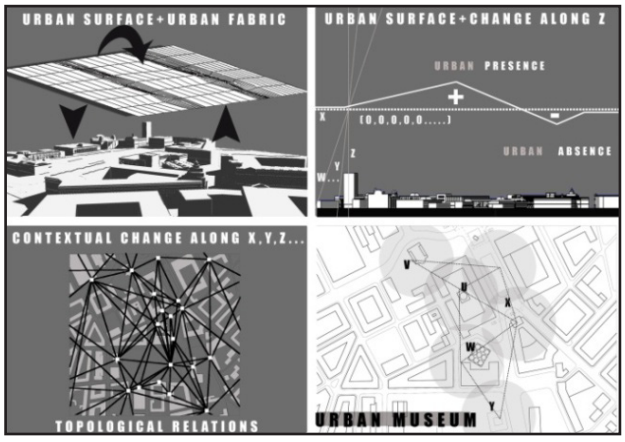

Figure 3: The Unification of Micro and Macro Urban Structures – Quantification of the City

to define particular amount of information about any elements and their possible relations in any systems given. Going back to the Urban Hypersurface, the question of what its dimensions could represent can arise.

During the design process several experiments with n-dimensional geometrical projections were made. These experiments along with the examined case studies revealed that the spontaneity and artistic unpredictability of art and design could be limited when using only mathematical rules of how geometrical projections of higher dimensions are formed. Since n-dimensionality could be assigned to different variables, the one of direct geometrical transformations was rejected as a design approach. Instead, several other variables were tested in urban experiments. As a result from the site specificity, n-dimensionality was explored in the design process as contextual and cultural layering.

The rich historical layering of the city of Sofia allows for transforming n-dimensionality into the fusion of contextual information.

The design proposes to develop specific critical points in the city by applying series of Urban Hypersurfaces. The goal is to allow these surfaces to carry the information about the history and context of the city and at the same time to challenge the existing contextual information on the site by forming contextual site-specific derivatives. The choice of the critical events is based on their richness in historical and cultural background. Some points are exposed on street level; others are to be excavated from the remains of the ancient Roman city of Serdica; and some are to appear above street level, developing the city in a vertical direction. Mosques from Ottoman rule, religious buildings such as the modern Catholic church, the Early Christian basilica, the Eastern Orthodox church of Sveta Nedelia, and the Synagogue all exist in the city within only several urban blocks. This extraordinary co-existence of multiple monuments, belonging to different religions and cultures, is not only a historical artifact; it also refers to current urban lifestyles, therefore, to possible programmatic design issues, since the monuments still function and embrace different users. Because of the relations among those various locations in the city, a uniform urban approach of discrete connecting and separating is carried out in the developed project.

Therefore, the design proposes an urban historical museum, connecting all these important locations in the city, by means of interconnected Urban Hypersurface deformations. In this respect, the historical museum becomes an urban event, made of discrete critical points of reference in the city, all of which are connected to one another by infrastructural and visual changes in the Urban Hypersurfaces.

For the purpose of this study a specific location, called the critical point Y, is developed in more detail, exploring how the urban transforms into local and vice versa.

The critical point Y represents the City Garden in Sofia. The site used to be the garden of the former Royal Palace, built in 19th century. After change in the political regime, the garden was transformed to host the mausoleum of the communist leader Georgi Dimitrov. The mausoleum was built in 1946, and was demolished in 1999 after democracy came into rule again.

The City Garden is still functioning today as one of the many green areas in Sofia. The existing urban fabric of the city follows the urban master plan, dating from 1934, which stipulated radial urban

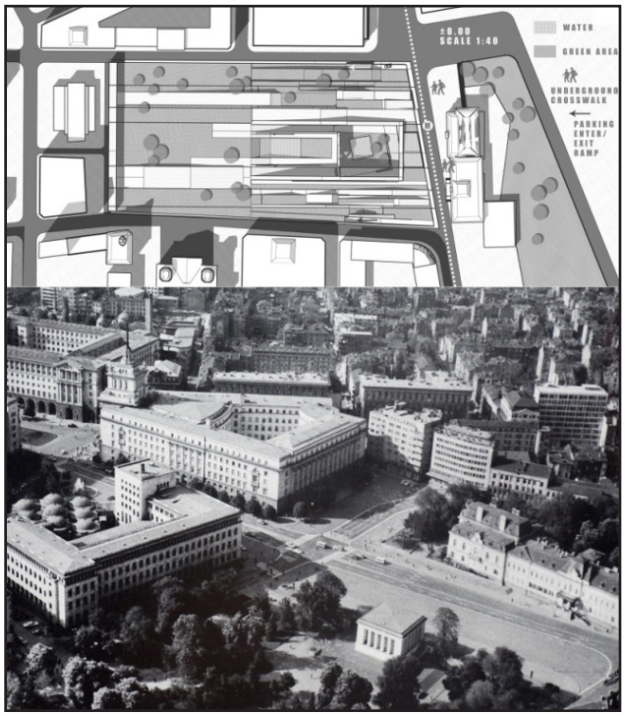

Figure 4: The Urban Quanta - Spacetime Y

pattern and green zones, located in the four world directions. It was this city master plan that proposed the transformation of Sofia into a *City as a Garden*. That is why the City Garden holds not only historical relevance to the urban heritage of Sofia, but also conceptual one.

After the specific site was analyzed in terms of traffic and pedestrian flows, types of users, historical and cultural influences, the design for the historical museum at critical point Y was developed. The program includes underground car park area, underground museum, underground pedestrian crosswalks, underground commercial area with shops, cafeterias, restaurants, and green park at street level. All programmatic zones are designed to be physically connected for the purpose of forming n-dimensional connotations between the various contexts. The design also proposes a new subway stop in front of the former Royal palace, now being National Art Gallery.

The designed urban interventions in the City Garden exclude the two existing buildings on the south from the territory of the garden by introducing new street pattern and above-ground row of pavilions. These pavilions serve not only to accommodate temporal park exhibitions and events, such as to shelter the regular chess players on the site, but also to establish an urban boundary between the new garden plot and the old urban fabric. Moreover, the urban pattern is reshaped in a way to return the axial procession towards the National Art Gallery, the formal Royal palace, which was broken in early 20th century by the artificially created new axis towards the theater building, situated to the east. The intervention does not have the intention to embrace the system of monarchy, which the Art gallery might evoke, being the former Royal palace. The reasons for such an urban shift are purely formal and infrastructural, rather than political.

The spaces proposed in the design for the City Garden serve all users on site: pedestrians in the green area; office workers in the adjacent bank building; visitors of the National Art Gallery and the City Art Gallery; visitors of the Sofia Grand Hotel; visitors of the National Theater, and tourists.

The museum spaces and the car park spaces are related morphologically as part of the Urban Hypersurfaces, which rupture and create their own subspaces. The contact zone between the museum spaces and the car park lot is divided in two areas: one, forming continuous inclined and declined floor slabs, and the other, forming a transparent glass separation wall, which exposes the museum spaces in front of the car park structures. The entrance and exit ramps for the car park are separated by glass partitions to allow for the constant experience of the moving city in all its forms. Similarly, the subway tunnel is partially exposed, providing constant visual and sound information about the passing trains. The lights from the car park intrude the museum spaces through the glass partitions and reveal the pattern of the daily routine of the users on site. The museum spaces are adjacent to the main pedestrian flow of the underground crosswalk, allowing for the museum to become intrinsic part of the city. The museum spaces are designed to exhibit mainly interactive information about the history of Sofia, such as media and sound performances, conferences and happenings. The museum connects with some storage spaces in the car park premises; however, the proposed design suggests that mainly urban activities would take place in the museum, rather than permanent expositions of physical historical artifacts. The museum spaces flow into the City Garden by means of repetition of inclining and declining series of parallel ramps and stairs, spanning the street level with level -11.00. The morphology of the open garden space, located at level -11.00, is formed by tracing the footprint of the demolished mausoleum building. The forces of urban absence regulate the inversion of the Urban Hypersurface below the street level. Thus the rebuilt reminiscence of the mausoleum footprint is assigned new urban function, serving a continuous public bench structure, 50 cm high, moving in and outside of the new underground museum premises.

The materials proposed in the design are wood and concrete, mixed with the presence of vegetation and water, both as landscape and interior elements. Water is used also as a design tool for the reflection of the memory of the obliterated urban form. Several garden ponds are used at ground level +0.00, as well as at level -11.00, accompanied with series of water channels, running through the whole site of the City Garden.

The ground level of the garden, designed as a roof of the underground spaces, is fragmented into series of declining and rising surfaces, which allow

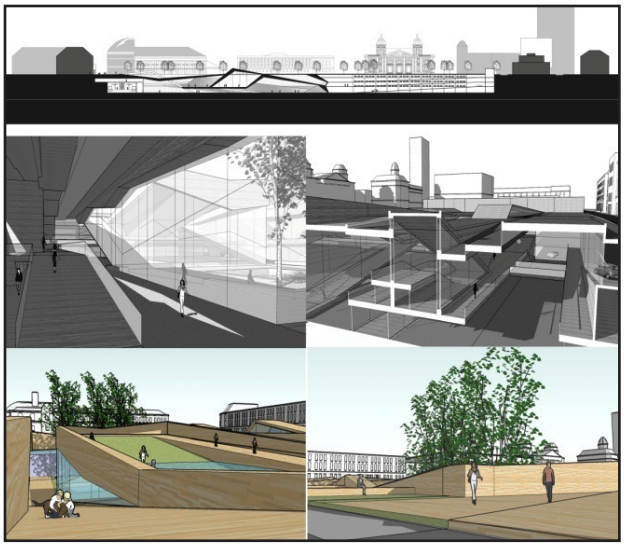

Figure 5: The Urban Quanta - Local Rupture of the Urban Surface

for different views inside and outside of the underground premises. The surfaces, covered predominantly with wood, define all bench structures as well as some of the museum floor slabs. The use of wood is dictated by the need to introduce an atypical for the site material, which would simultaneously link and separate the spaces not only formally, but also conceptually. Since the existing building environment is mainly made of monolithic stone and concrete structures, wood is chosen as a material not only to form the contrast between the old urban patterns and the new ones, but also to enhance the organic identity of the garden itself.

Thus the proposed design for the City Garden explores the possibilities for exaggerated formal and contextual connections of spaces, which by the individual appreciation of the different users could turn into the constantly changing spacetimes of Sofia.

THE MUSEUM AS AN URBAN EVENT

The design study, described in this research, raises questions not only about the transformation of micro into macro structures and vice versa, but also of the basic urban design approach towards locality. It defines a new approach towards the connectivity of the urban tissue and towards the scope of interaction between infrastructures. It is not only the physical scale of interconnectedness that is subject to reconsideration, it is also the semiotic system of urban interaction that is presented with new opportunities.

The design for the historical museum turns into a fractal of an urban system which could be interpolated to infinity as long as technology and science allow. The museum becomes not merely a building, but a huge infrastructure with various urban possibilities for future development. The different designs for spaces X, Y, Z, proposed in the new urban master plan, are only few discrete points, which are linked by their infrastructural and contextual quantification. All designs of the different spacetime locations X, Y, Z, etc. are not only possible design solutions for one and the same place; they are possible solutions for multiple, but connected, futures of one and the same place. Their design objectives and infrastructural parts are related by the methodology of the Weak Formation in order to produce a coherent single matrix that is self-reflexive, self-developing, and self-sustaining, both in its change, and its stasis.

ENDNOTES

1 Konstantinos Apostolou Doxiades, and J. G. Papaioannou. *Ecumenopolis*: The Inevitable City of the Future, (New York: Norton, 1974).
2 Christopher Alexander, Sara Ishikawa, and Murray Silverstein. *A Pattern Language: Towns, Buildings, Construction*. Center for Environmental Structure series, v. 2, (New York: Oxford University Press, 1977).
3 Jane Jacobs, *The Death and Life of Great American Cities*, (New York: Vintage Books, 1992).
4 Le Corbusier, *The Radiant City; Elements of a Doctrine of Urbanism to Be Used As the Basis of Our Machine-Age Civilization*, (New York: Orion Press, 1967).
5 Mustapha Ben Hamouche, "Can Chaos Theory Explain Complexity in Urban Fabric? Applications in Traditional Muslim Settlements," *Nexus Network Journal* 11(2009): 217-242.
6 String theory is an attempt to combine the major theories in physics – Quantum theory and General Relativity, which cannot coexist so far without a mathematical contradiction. The theory of the small, Quantum theory, and of the big, general relativity, both use point-like particles for the main ingredients of the matter. String theory comes with the idea of extended particles, called strings, thus unifying the point-like and wave-like behavior of the observed in classical physics particles. String theory uses complex topological n-dimensional mathematical apparatus, stating that there are more than three spatial dimensions existing. The theory is still not proven experimentally.

All illustrations are produced by the author.