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INTRODUCTION

With the increasingly dramatic impacts of the pandemic affecting the society, economic and political situation in every state of the world, blue green territories become more essential in the urban agglomeration.

The summarized researches underline that we cannot allow losing our cultural and historical heritage in the period of economic expulsion. Many various epidemic waves passed throughout the centuries, but the previous generations tried to preserve the pearls of the cultural heritage.

The characteristic feature of the 20th / 21st century is a pronounced change in the nature of small towns. A rapidly growing pace of technologic innovations in the field of science, national economy and social sphere makes an imprint of the technological processes which can be noticed in terms of urban development, proportion, changing outline dominants and the volume of green structure.

At a state policy level, small towns are often undeservingly left out or underestimated despite the fact that people are looking for a slower pace of life. Small towns can offer a much stronger feeling of identity and devotion, local production, cheaper real estate and closeness of nature territories.

A research regarding Kaunas by Lithuanian architects demonstrates that modelling of a former military fortification city is an example of the synthesis of the cultural heritage of the city and the innovative tendencies of the 21st century. The model is based on the evaluation of the changes in the structure of the city. The city boundaries can serve both as a catalyst and a tool defining the important conditions for the composition of a city structure. The research is based on the aspect defining that the boundaries affect the multidimensional nature of the urban environment. A multilayer evolution is dominating in the urban designs with the aim to analyse and summarize the condition and the tendencies of the collective memory, which is connected with a creative process of looking for the balanced perspective of the inhabitants and the landscape designers, which is reflected in the projects offered. A mould-breaking search is also reflected in the research related to a balanced functional design of pedestrian zones in the urban environment.

The material regarding the temporary use of unidentified lands is appealing and provides a possibility and a flexible way of exploring the prospective use of territories.

One of the researches investigates the process allowing for the withdrawal from the traditional landscape with thousand-year-old traditions towards a ground-breaking shoot in the 20s of the 20th century based on avant-garde and cubism trends. The Chinese garden is used as an example.

PRIEKŠVĀRDS

Pandēmijai aizvien dramatiskāk ietekmējot sabiedrību un valstu ekonomiski politisko stāvokli, lielāku nozīmi pilsētvides aglomerācijā ieņem zili-zaļās teritorijas.

Apkopotie pētījumi akcentē, ka ekonomikas izdzišanas periodā nedrīkst pazaudēt kultūrvēsturisko mantojumu. Gadu simteņos pāri ir vēlušies vairāki slimību viļņi, bet iepriekšējās paaudzes ir centušās nosargāt kultūras mantojuma pērles.

20. / 21. gadsimtam ir izteikta mazo pilsētu rakstura maiņa. Straujai tehnoloģijas tempu ienākšanai zinātnē, tautsaimniecībā un sociālajā sfērā, veidojas tehnoloģisko procesu "pēda", kas ir pamanāms apbūves mērogā, proporcijā, mainoties dominantēm siluetā un zaļās struktūras apjomam.

Mazās pilsētas valsts politikas līmenī bieži tiek pamestas novārtā, vai nepelnīti novērtētas par zemu, lai gan cilvēki meklē lēnāku dzīves ritmu. Tās var piedāvāt daudz spēcīgāku vietas identitātes sajūtu un pieķeršanos, vietējo ražošanu, lētāku nekustamo īpašumu un tuvumu dabas teritorijām.

Lietuvas arhitektu pētījums par Kauņu parāda, ka bijušās militārās nocietinājuma pilsētas modelēšana ir kā piemērs, kur sintezējas pilsētas kultūras mantojums un 21. gs. avangardiskās tendences. Modelis ir balstīts uz izmaiņu novērtējumu pilsētas struktūrā. Lielpilsētas robeža var būt gan katalizators, gan instruments, kas nosaka apstākļus, kas ir nozīmīgi pilsētas struktūras veidošanā. Pētījuma pamatā ir aspekts, kas noteic, kā robežas ietekmē pilsētvides daudzdimensionālo raksturu. Pilsētplānojumos dominē daudzslāņu evolūcija, kuras mērķis ir analizēt un apkopot kolektīvās atmiņas stāvokli un tendences, kas saistītas ar iedzīvotāju un ainavu arhitektu viedokļu kopsaskaņas meklējumiem radošajā procesā, kas atspoguļojas piedāvātajos projektos. Avangarda meklējumi atspoguļojas arī pētījumā par pilsētvides gājēju zonu funkcionālā plānojuma harmoniju.

Saistošs ir materiāls par nenoteiktu zemju pagaidus izmantošanu, kas kalpo kā iespēja un elastīga metode meklējumiem teritoriju izmantošanā perspektīvē.

Viens no pētījumiem izseko procesam, kā attālināties no tradicionālās ainavas ar tūkstošgadīgām tradīcijām uz 20. gs. 20. g. revolucionāro izrāvienu, kas balstīts uz avangarda un kubisma uzskatiem. Kā piemērs izmantots Ķīniešu dārzs.

Aija Ziemeļniece
Editor in Chief

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Changing character of town form during the XX−XXI c.: the case of Lithuanian small towns

Agnė Vėtė, *Vilnius Gediminas Technical University, Lithuania*

Abstract. Although towns are constantly changing, changes may have a major impact on town character. Town character reflects the distinctiveness of town form and there is a risk that town may change unrecognisably. This issue is particularly close to small towns, which characters are especially fragile. Additionally, small towns are often neglected or undeservedly underestimated, though people already are searching for slower life and more authentic experiences. Nevertheless, small towns can offer close community, sense of place and attachment to it, local production, cheaper real estate and safe, sustainable environment. Undoubtedly, counter urbanisation processes are underway and Lithuania has a lot of resources for slow town concept development. Lithuanian urban settlement system consists of mostly small towns, so the research of changes of town form and their impact on the town character is extremely important. The article discusses what causes changes in small towns, paying the particular attention to the Lithuanian context. Initial methodological guidelines and insights give basis for further investigation and levels of changes are categorised. Preliminary findings state that due to the level of maturity, completeness of town form in relation to the ideology of the period and on the consequences of World War II, transformations had a different impact on town form during the second half of the XX c. and the extent of changes differ. The concept of the research is illustrated with a case study of Anykščiai town which analysis of changes of town form allows to define main transformations and actions for nurturing the character of the town. The article presents the assumption that the complex research of changes of town form may enable a possibility to identify the model of the town form character and define the townscape capacity.

Keywords: town form character, townscape capacity. small town, post-war urban transformations, Anykščiai

With the process of globalisation and integration in the world, the convergence of the nations of the world and their cultures is inevitable, but at the same time the identity of nations may be lost. This process affects many areas, but has a particularly strong impact on the cities and towns, which are gradually losing their character of town form [1].

Introduction

As a result of decentralisation, various processes began in the post-socialist countries of Central and Eastern Europe in the 1990s: the privatisation of real estate, the conversion of agricultural land, the emergence of the middle class as a new social class of the rich, new commercial and spatial needs in a rapidly evolving capitalist society, the arrival of the activity of investors and developers, and the creation of a culture of privacy. Active processes of transformations are observed in the indepedent Lithuania after 1990, as in other post-socialist countries, which include not only social, cultural and economic spheres of public life, but also qualitative and quantitative changes in urban systems of various levels – physical and functional parameters of urban structures are changing [2]. In general, urban development in post-socialist countries can be described as free market concentration in the sector of private property, which has affected not only urban sprawl processes but also overall uncoordinated external and internal urban development [3; 4; 5]. Under such conditions, the overall visual appearance of town form becomes a non-priority issue and presupposes local drastic changes or, conversely, the neglect of significant structures in towns.

Contemporary problems of town form are inseparable from the assimilation processes in towns that have intensified in the 20th century. It is difficult to maintain local character of towns when they are invaded by signs of global architecture and the desire to attract the attention of investors [6]. Looking at the historical urban development of Lithuanian cities and towns, the influence of Western and Central European countries on Lithuanian cities and towns became appearant already in the 15th century [7], which is still important today due to close economical and political ties. Of particular importance is the Eastern influence that dominated the socialist countries in the second half of the 20th century through standardised transformations and, in many cases, unrecognisably altered townscapes that even after regaining the independence are still not sufficiently assessed. Not only issues of the resemblence of towns and loss of character, but also survival questions are relevant in Lithuanian towns (due to limited resources, utilitarian needs are the priority). The problem of population decline is especially important for Lithuanian small towns, which is related to the reduction of the economic viability and

attractiveness of a town. Without being an economically strong town, the challenge is how to create the image of a captivating town that not only retains town's current population, but also attracts tourists or new residents. Nowadays, it is more popular to comment the quality of living environment from the social, cultural, ecological, mobility points of view than to discuss peculiarities of towns and how to preserve, maintain or reinforce it in the context of transformations of last century. After all, the innate need of human is to experience uniqueness and that is why the strenghtening of town character can play a pivotal role in the development of the town economy [8]. Additionally, contemporary trends in sustainable development dictate the necessity to look not only at ecological aspects, but also to protect the distinctiveness of place for future generations. However, small towns are still not seen as having all resources to fulfill requirements of sustainable environment and having huge potential to offer unique experiences due to their peculiar town forms.

The relationship between urban form research and urban planning and urban design practise has become a crucial debate at the international level in the last decade [9]. A research on the urban form provides a methodological basis, knowledge of how the physical form of cities or towns is changing, transforming and what are the characteristic features of particular place. The collection, processing, systematisation and comparison of such data are very important in the preparation of urban planning, urban design projects or other kind of documents which deal with the issues of urban form and its unique character. This is especially relevant for Lithuania and many other post-socialist countries where the traditions, research methods of urban morphology and their application in practise have not yet been established or strong enough. Furthermore, the impact of changes on the town form, townscapes during XX–XXI c. has not yet been thouroughly investigated: the relationship between architecture and ideology, the question of national identity and the evaluation of Soviet architecture in contemporary society are still important topics [10]. Also, the world recognises that it is better to add today's circumstances to existing urban form than to transform valuable features. The originality and professionalism of an architect is manifested precisely when he ensures the continuity of traditions in the contemporary world [11].

The aim of the article is to introduce to the issue of changing town forms of Lithuanian small towns during the XX – XXI c. in relation to the town character (the small town has a population of up to 20 thousand in the context of Lithuania [12]). The article presents challenging background of small town development, which causes changes and may damage the character of the town. After regaining the independence, the focus is on the largest cities in Lithuania. Central parts of small towns in many cases have fundamentally transformed during the socialist period and due to the challenges of shrinking towns, they remain unchanged. The changes, transformations of Lithuanian small towns and their impact on the character of the town have not yet been studied in detail, though majority of towns in Lithuania are small (only 14 out of 103 have more than 20 000 residents) and their unique character is under the threat to be neglected or left transformed unrecognisably.

Key concepts and background of the research

Urban form is a physical, built form of an urban place [13]. Fundamental composite elements of urban form and principles of analysis are [14]:

- Urban form is defined by three main physical elements: the building and spaces associated with it, plots and streets;
- Urban form can be perceived on four different scales: building – plot, street – quarter; town, city; region;
- Urban form can only be understood on the basis of history, because the elements that shape it are constantly changing.

Town form is used in the article to indicate that the object is not a separate urban unit but a town as a whole. Town form can be generalised by town character. Town character is: peculiarities of a place; models of development, townscape and use; a combination of all aspects that sets a town apart from others. Townscape is a visual appearance of town form [13]. In order to maintain town character, limits of change of town form start to be questionable.

Changes of town form can be caused by several main factors: natural growth; catastrophes; globalisation, internal forces. The natural growth usually causes more dense inner structures and new external development which follow and extend existing patterns. Also, even the planned development can bring the same effect. Nowadays, a town form mostly is changing due to globalisation and internal forces: political, economical, social and cultural factors [15]. Changes of town form can also be caused by disasters, catastrophes which were influenced by humanity or nature [16]. Usually, if there is no strong political, ideological background, towns recover from disasters by continuing the former tradition. The post-war period is an example how political, ideological background can have a major impact on changes of town form. Therefore, changes can be defined by comparing the town form to itself in its original state and by taking into account the processes that led to certain change.

Globalisation, assimilation processes are undoubtedly one of the most important challenges today and in the future. The Gregorian calendar, which spread at the end of the 19th century, is like a symbol of the beginning of standartised international processes [17]. The period from 1750 to 1939 brought a great deal of transformations in the world, which led to an abundance of ever-changing ideas for the urban development. The following fundemantal changes in the 18th–19th centuries, which caused intensive urbanisation processes and urban transformations, can be distinguished: cultural transformations (perception of human powers against the nature; the formation of working class; technological possibilities and changes in people's consciousness have encouraged them to get to know more about their history and environment); technical transformations (inventions of steam engine, systems of metallurgy, railway, bridges and agricultural technologies; improved medical technologies, though rapid urbanisation and travelling possibilities caused outbreaks of diseases; modular building systems shortened construction time and enabled high-rise buildings); territorial – spatial transformations (growing population, mobility, traffic flows, the strive for better hygiene and healthier environment led to transformations of urban form; more greenery started to appear in urbanised areas; axis was not used for the formation of urban structures – it was seen as an open and promisingly expanding structure) [18; 19; 20].

The process of modernisation in Eastern Europe started in the late 19th century. Modernisation is characterised by the dissemination of knowledge and information that has affected cities and life in them: local, elite-formed government and growing influence of political parties; international acitivities of urban planners, urban designers and architects; new infrastructure, development of railways, tram, electricity, gas and other networks, improving sanitation; creation of philharmonics, museums and other institutions where both local and "European culture" could be demonstrated; the growth of universities and the creation of other new educational institutions [21]. Soviet planners formulated the concept of socialist urbanism in the 1930s, which fundamentally shaped urban development in Eastern Europe in the later decades and led to functional segregation between industrial and residential areas and elongated green spaces. After the collapse of communism at the end of the 20th century, the political and economic context changed dramatically, and the forces of global economy became apparent [22]. A rapidly changing world, international architectural styles, shopping networks, pop culture are increasingly associated with the loss of identity and the disappearance of distinctive features of places.

Nowadays, the perspectives of urban development are drawn not only by municipalities, individual institutions of countries, but also by European and the world institutions, organisations. Although organisations (European Union, European Commission, World Health Organisation, UNESCO, etc.) and various programs, documents (ESPON, European Spatial Development Perspective, New Urban Agenda, etc.) represent the strive for a human well-being, but also are examples of standartised processes that have been in place for many years. Nevertheless, this is the case when standartised processes are implemented with an aim to preserve and nurture local character in the context of globalisation. Global organisations seek to guarantee equal opportunities for people, and one of them is the freedom to choose how and where a person wants to live. In order to respond a demand, cities and towns face the question of image – what it can offer to potential resident or tourist. This results a bigger competition between towns and cities, an even greater significance of their distinctive character, and better opportunities for small towns to revive.

Modernisation, globalisation, standartisation did not bypass small towns: external governance dominates, the local economy is undermined by the displacement of local businesses and the acceptance of the universally accepted, towns become more similar and have less capacity to retain their local character. Shrinking small towns are experiencing a decline in public services and a resource-based economy, abandonment of the cultural landscape, increasing areas of unused land and emptied housing, social exclusion and lack of political vitality, an aging population. On the other hand, small towns are like an oasis in a rapidly changing world, away from noise and pollution. They can offer a small close community, a sense of attachment to a place, and a less standartised, homogenised environment. Small cities can suggest a sustainable future by reaping the benefits of their cultural, economic and natural environment. Counterurbanisation processes began emerge in the 1960s as opposed to globalisation and intensive urbanisation. One-fifth of people live in small European towns, and in more intensively urbanised, metropolitan regions, as many as a third or a half in some cases. There is a strong growth of population in small towns (population up to 50 000) in the U.S. [23]. Due to the development of technology, better travelling conditions and opportunities to work and receive services or goods remotely, small towns are emerging as attractive living environments, which can offer slow life and exceptional character. Therefore, researching and nurturing the character of small towns and adapting it to the contemporary needs is the key not only to solving the issues of

small towns survival or uniqueness, but also to respond to promising trends. Unfortunately, the changes, transformations of town form, their impact on the town character and the townscape capacity have not been studied in detail in the small towns in Lithuania.

Historical urban development of Lithuanian small towns till World War II and subsequent changes

Most of European small towns emerged in the early Middle Ages as spiritual, defensive, administrative, educational centres in the feudal system. As the need for the military grew, more taxes had to be collected and people where forced to sell more. As a result, agricultural and craft production began to grow. Emerging specialisations and rising trade provided the basis for a new phase of urbanisation based on merchant capitalism. Starting in Italy, a dense network of market towns quickly developed through Europe. In many cases, this was the period during which the forms of towns were shaped, which were later supplemented by industrialisation and modernism [23]. Although, there is a great variety of towns, but they always developed close to important roads and waterways. The main structures in towns where castles, manors, churches, monasteries and the market square. The main street usually widened towards the market and the square changed according to the size of market and the adjacent shops. With the growth of towns, the need for new structures and functions emerged: hospitals, schools, town halls, a rectangular plan has been introduced, etc. Until the 19th century, towns and cities clearly reflected the culture of society and formed a cohesive structure based on military, religious or societal symbols that enabled residents to form a connection with the environment [24]. The industrialisation accelerated and the importance of markets decreased during the 19th century, which led cities and town to become more prominent by function: The economic changes of the 20th century can be seen today in abandoned factories, unused land, changed appearance of main streets and squares, and spread of standartised networks. Urban development was projected on the basis of the land ownership and infrastructure development rather than a historically formed plan [25]. The impact of globalisation on towns and cities become extremely apparent: standartisation, rationalisation, homogenisation.

Lithuanian towns began to grow at the end of 13th century and were forming when towns and cities in Europe were already developed. From the very beginning of the formation of the state of Lithuania, cultural exchanges took place and their traces can be seen in the town forms: a spontaneous urban development was until the 15th century in the Grand Duchy of Lithuania, which included present-day Belarus, part of Russia, Ukraine and Poland, and later Latvia and Estonia; the first plans of settlements were drawn up for the Wallachian reform in the 16th century, which was influenced by the Gothic; the Renaissance and Baroque ideas influenced the formation of urban complexes in the 17–18th centuries; after Lithuania was included in the Russian Empire, master plans for urban reconstruction were prepared according to the example of Russian cities [26]. At the beginning, with a low level of crafts, Lithuania was a raw material base for neighboring countries. The movement of trade roads shaped the streets of towns. Due to the streets going to the market square or fortress, in many cases, a radial plan was formed. The introduction of Christianity brought churches as almost the only landmarks in towns. The emergence of Magdeburg rights, the creation of organistions of workshops, military and the establishment of manors also had a significant impact on the changes in the town form. Over the time, each town developed its own traditions, giving the town its own character [27]. According to Lithuanian researches, it can be stated that Lithuanian towns were maturing, forming until 1940 and later underwent transformational as well as new urban development processes. Since small towns in Lithuania were not as fully formed and developed as other European towns by that time, it can be presumed that their character formation was more disturbed. Also, it can be assumed that small towns in Lithuania are very fragile and even minor changes may have a great impact on their character. Based on researches on town form character of Lithuanian small towns, it can be summarised that the following general peculiarities were formed till 1940 [27; 28; 29]:

- Lithuanian towns did not repeat the urban traditions of Russia or Western Europe – they have many peculiarities that depend on the cultural level of country, the development of productive forces and geographical location. Radial and linear plans according to the natural conditions are especially characteristic;
- Lithuanian towns were dominated by a network of winding streets with closed street perspectives and multifaceted visibility;
- Central parts of towns were compact, densely and regularly built. Buildings usually faced the square with their ends or, in some cases, with their sides and passageways between buildings leading to the square were formed;
- Different sizes, shapes, proportions of squares and unique connections with main streets, residential areas determined a great variety of squares and town form character. The relation between square and buildings had not yet acquiredt the maturity of a well-organised space;

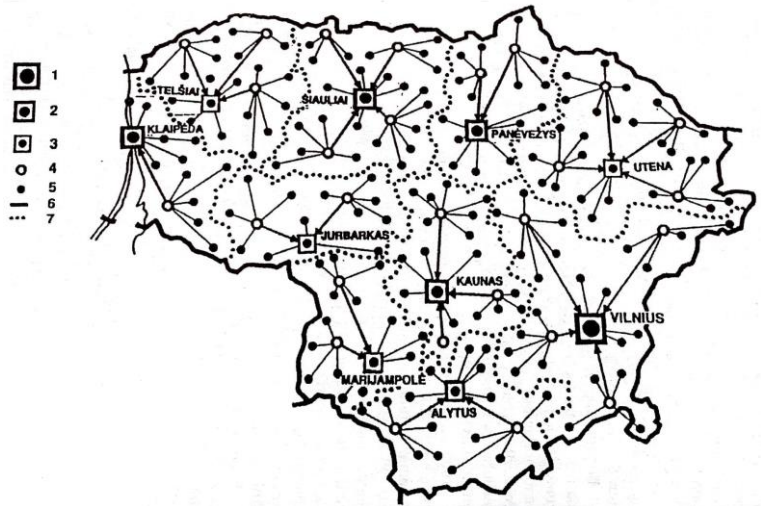

Fig. 1. Scheme of the development of a unified urban settlement system in the territory of Lithuania in 1964: 1 – capital Vilnius; 2 – developing regional centres based on cities and medium towns; 3 – developing regional centres based on small towns; 4 – developing district centres; 5 – local centres [32]

- Moving away from the square, 2.4–3.1 times less dense built-up area and more greenery. Central parts of towns, public centres were not surrounded by greenery, except for the church environment, which was often only one landmark in town.
- The architectural expression of buildings is characterised by: the harmony between nature and construction; the dominance of gable or quadruple roofs in building volume; rhythm, local materials and natural light shades were used to accentuate building structure without exaggerated decor.

In the post-war period, industry, administration, services, transport and natural features were essential factors in planning urban development and changes [30]. Most of the urban planning projects were completed till 1956, which were characterised by regular shape blocks – a regular single-line plan that offered uneconomical street network. The new streets of single family houses seemed dull, trite and often a stark contrast to historic buildings appeared, as the old streets were picturesque and resilient to natural obstacles. Furthermore, roofs were formed at 25 – 45 degrees, although roofs of 42 – 48 degrees were common in Lithuania [31]. Later, the scheme for the development of a unified urban settlement system in the territory of Lithuania was prepared (Fig. 1). This scheme strengthened the polycentric urban settlement system in Lithuania, emphasised role and importance of smaller towns, and gave an impulse for further and more intense transformations in small towns: redevelopment of central parts of towns, development of industrial areas, multi-storey complexes, etc.

After regaining independence, the following changes were observed in smaller towns: reconstruction, demolition or construction of new single family houses; the ground floors of single family houses and multi-storey buildings are started to be adapted for commercial and other functions that change the architectural expression of buildings and the street view; urban development is oriented to individual needs (construction of standartised shopping centres, single family houses, farmsteads, gardens, etc.); larger industrial complexes are being abandoned and smaller ones transformed; the construction of utility buildings became more important; paving, landscaping of urban public spaces are being renovated and supplemented by monuments and other elements [33].

Nevertheless, it is still unclear: how town form was changed; which changes in towns can be called as transformations that had a major negative impact on town form character; how those changes, transformations could be evaluated in the context of the whole town as a process; is it possible to find general strategies for solving the issues of particular transformations which would be suitable for more than one town or standartised urban development changed towns completely different; what is the townscape capacity – where is the line which can not be crossed in order to maintain at least essential features of Lithuanian small towns.

Concept of the research. The case of Anykščiai

A general idea of the research is to identify peculiarities of changes of town form of Lithuanian small towns after the World War II in relation with town character: what is the extent of changes in towns; did those changes transform essential features of town and some actions are needed; is it possible to identify the model of specific town form or a model could be the same for more than one town. For the first stage of the research it was chosen to analyse those small towns, which were defined as the most distinctive ones. According to the resolution of the Council of Ministers of the

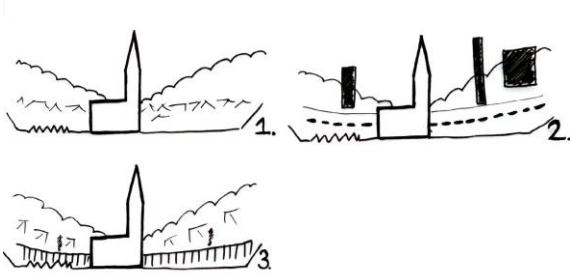

Fig. 2. Substantial value and transformations of Anykščiai town form character (1 – key feature: the church dominates in a Šventoji river valley, surrounded by green slopes; 2 – key transformations: industrial, multi-storey buldings are overshadowing the church and green slopes, the old part of the town is not identifiable; 3 – possible actions: clearifying the structure of the old part of the town, eliminating visual pollution in order to emphasise the church, strenghtening the town structure by accentuating peculiarities of the terrain)

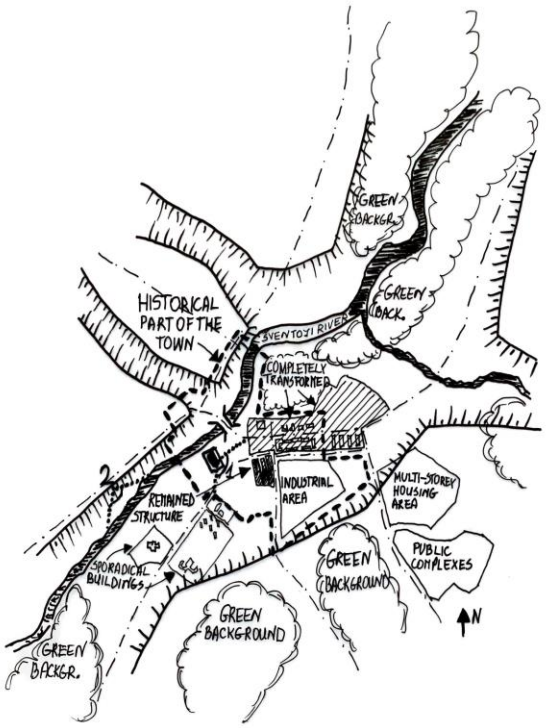

Fig. 3. Major transformations in Anykščiai town which have an impact on the town form character

LSSR of 1963, the order of the Minister of Culture of the LSSR of 1969, the order of the State Construction Affairs Committee of the Council of Ministers of the LSSR of 1969 and the resolution of the College of the Ministry of Culture of the LSSR of 1988, a list of 67 urban monuments of Lithuanian SSR settlements was defined [34]. 29 out of 67 are small towns and considered as potential objects of the research. Since the research is ongoing and methodology is constantly adjusting, the article presents initial methodological guidelines, insights and shows Anykščiai town as an argument for the need of such kind research in Lithuania.

First of all, historical urban development of towns is analysed considering political background (e.g. ideology, orders, plans), cataclysms (e.g. war, flood, fire), vitality (e.g. economics, culture). Secondly, changes of street network, structure of blocks and their form, building principles, structure of urban public spaces are measured in comparison to their original form (mostly formed till World War II) and relation with natural environment. Changes are comprehensively categorised into different levels:

1. Substantially transformed structures, which already had a particular form before World War II (street network, blocks structures were changed);
2. Partially transformed structures, which already had a particular form (mainly single objects appeared or changed);
3. Changed structures, which had not had a particular form (extended, densified street network and blocks structures);
4. Unchanged or slightly altered structures which already had a particular form.
5. New urban development territories which have not yet undergone transformational processes.

Such collection of data provides primary knowledge about extent of changes and differences between towns. Although the same ideological principles of urban planning were implemented in towns, the nature and extent of changes in towns differ to several key factors:

- what maturity the town form had reached (the absence of vacant areas and the strength of urban composition often led to a lower degree of changes in the central part, e.g. institutions, public services were established in existing buildings);
- what is the extent of the consequences of the war (empty areas led to the favorable conditions of building new types of structures);
- how the existing plan structure corresponded to the ideology of that time (e.g. in the first half of socialist period, regular blocks of single family houses were compacted and expanded; classicist principles of axial composition were respected).

So the case of each town is individual and though it is possible to distinguish common types of changes, their scale and impact on the particular town may be different. It confirms the assumption that in order to define the model of specific town form and to measure the impact of changes, not only each town should be analysed separately but the results should be compared as well. An individual study of the town is aimed to specify cases of changes and their impact on the town form character including the fact that town form is constantly changing and the goal is not to conserve, but to maintain essential features of towns in contemporary world. The changes are planned to be summarised in the form of models describing the substantial change in town form character which would also help to define the townscape capacity (Fig. 2).

Fig. 4 Transforming townscape of Anykščiai: two pictures above before the World War II [35]; below – XXI c.

Figure 2, 3, 4 show an example of the town of Anykščiai in the north-eastern Lithuania. Regardless of the period of time, the town form character has always been identified by the relationship between the natural and anthropogenic environment: Anykščiai is located in the valley of the Šventoji river and surrounded by green slopes, which act as a background for the landmark – the highest church in Lithuania. However, the transformations of the 20th–21st centuries (Fig. 3) threaten essential features of the town form character. Firstly, some of the areas, destroyed during the war in the central part, were formed using larger-scale structures, and some were transformed by fundamentally changing the structure of blocks, the nature of the design principles and the spaces. Moreover, an industrial complex which emerged in the central part of the town and other complexes or separate buildings overshadow the dominance of the church and a common scale in the town. Finally, the green slopes which surround the central part of Anykščiai are disturbed by multi-storey buildings and other complexes. In general, some main features of Anykščiai town form still remain: natural environment is preserved, green slopes are still visible; street network basically is not changed; there are remains of common small scale block structures; the church still acts an important role in townscape.

Primary collection of data and analysis present possible priority areas for action (Fig. 2) which will be clarified in later stages of the research:

- Central part of Anykščiai consists of two potentially transformational areas: northern part could require regeneration; southern – conversion;
- Emphasis on church could be brought back by eliminating visual pollution;
- In order to maintain green slopes as a distinctive feature, areas of multi-storey housing and public complexes on upper terrace should be reconsidered.

The given example of Anykščiai shows that the detailed research of changes of town form and their impact on the town form character is necessary. It can be assumed that the complex analysis of the changes of town form based on the primary form and assessed not as a current situation, but as constantly changing process, can help to define the fundamental changes of the town form character and to determine the townscape capacity.

Conclusion

The impact of modernisation, globalisation, standartisation and other processes on town character is a constant discussion and is especially sensitive issue for small towns, which character is very fragile. Nowadays, small towns are often seen as an unattractive place to live and most of investments usually are focused on large cities. On the other hand, processes of counterurbanisation show that small towns are or will be an alternative type of living environment for people, who search for lower real estate and mobility costs, tranquility, greater variety of local production, less polluted, more communal and unique neighbourhoods. The character of small town is not only a significant survivol factor, but also a possibility to stand out among other towns or cities. However, since small towns are trying to meet at least the basic needs of residents and are fighting migration issues, their character is often not maintained and nurtured. As a result, changes of town form are not seen as a major issue, their effect on town form character is not evaluated and the threat to lose local distinctiveness arises.

Lithuanian towns as well as other post-socialist towns underwent major changes during the XX– XXI c., but the extent and specifity of town

form transformations is still not clear. The preliminar studies show that it depends on the level of maturity, completeness of town form in relation to the ideology of the period and on the consequences of World War II. Furthermore, according to the complex research which consists of analysis of changes of separate elements of town form, the extent of changes may be categorised into different levels. Also, mostly transformed areas can be defined and data may be compared with other towns, which could give insights about general situation in Lithuania or in wider context.

Nevertheless, situation of each town and their character are different as it was presented by unique example of Anykščiai. Anykščiai case illustrates particular issues and the need of actions: the central part was completely transformed during the second half of the XX c.; uniqueness of the church dominance in the green slopes background is disturbed. The initial investigation confirms the assumption that the model of essential features of town form is necessary. The introduced concept of the research presents changes of the town form as a process and searches for the limit of change beyond which the character distorts. The analysis may allow to identify the model of town form character and the townscape capacity. This base could also play a role in finding principles how to nurture the character in particular cases.

If the changes of town form and their impact on the character of the town are not studied, towns may continue to change unknowingly or dissapear from the map of the country. Therefore, especially in the regard that most towns of Lithuania are small, the establishment of the town form character model in the context of changes and the definition of townscape capacity are vital for small Lithuanian towns.

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Kopsavilkums. Lai arī pilsētas patstāvīgi mainās, pārmaiņām var būt liela ietekme uz pilsētas raksturu. Pilsētas raksturs atspoguļo pilsētas formas atšķirtspēju, pastāv risks, ka pilsēta var mainīties neatgriezeniski. Aktuālā tēma ir īpaši tuva mazajām pilsētām, kuras bieži tiek atstātas novārtā un par zemu novērtētas. Neskatoties uz to, mazās pilsētas var piedāvāt sabiedrībai vietas sajūtu, vietējo ražošanu, ekonomiski izdevīgāku nekustamo īpašumu un drošu, ilgtspējīgu vidi. Pētījumā analizētas Lietuvas pilsētas, pilsētu formu un rakstura izmaiņas. Rezultātā sniegts pieņēmums, ka kompleksa pilsētu formu izpēte var sniegt iespēju identificēt formas raksturu un noteikt pilsētvides ietilpību.

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Research on Changes of Spatial Structure Genotype of a Former Artillerymen' Military Town of Kaunas Fortress

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Abstract. Immovable cultural heritage creates a background for sustainable cultural development of cities. As a cultural artefact, it appears in two-fold situation in the above-mentioned context. Firstly, the continuity of the valuable features as carriers of cultural content should be preserved. Secondly, the possibility of the evolution (functional, spatial or social) of the object should be assured. Now the valuable features of the immovable cultural heritage are described in a static, quantitative ways with focus on phenotype, e.g. spatial volume, place, details of architectural style, number and places of windows, etc. Such type of description without any argumentations is practically closing any possibilities for further evolution of the protected objects. It is especially true if we speak about urban valuable structures. The authors of the article present a proposal for dynamic, genotype oriented modelling of the possible evolution of the former military town of Kaunas Fortress as an example of immovable urban cultural heritage. The model is based on the evaluation of changes in the cognition of urban structure with presentation of complex numerical values. Research included the following parts: historical urban development analysis of heritage territory, current state analysis, investigation and modelling of territory spatial structure genotypic changes. The results of the presentation demonstrate the limitations and subjectivity of the present system of description of valuable features of the objects of immovable cultural heritage and present the possible way for the improvement of the situation.

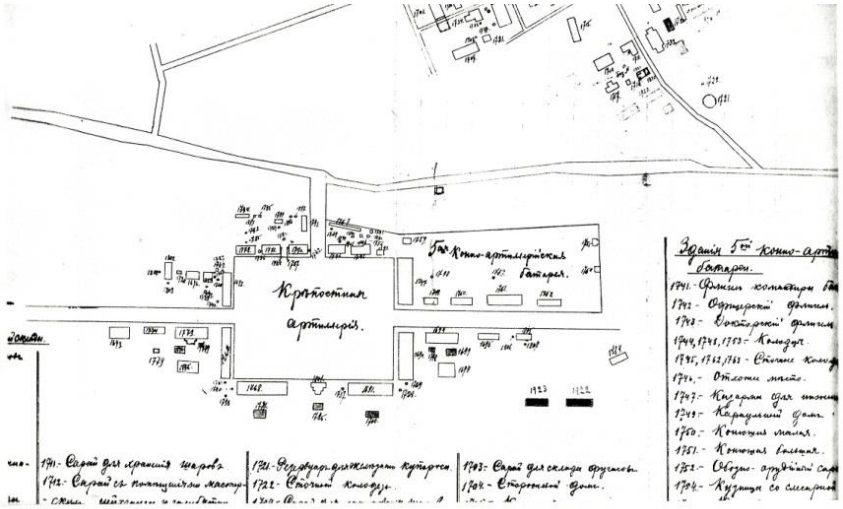
Key words: cultural heritage, valuable properties, fortress system, space syntax, cognitive frame

Introduction

The article was prepared on the basis of the research focussed on evaluation and prediction changes of valuable features of immovable cultural heritage. The study was ordered to be carried out by Juozas Vitkus Engineering Battalion in order to find out if the planned construction of prefabricated structures will not affect the historical spatial genotype of the protected urban structure. The investigated territory is a part of the complex of Artillery barrack buildings of Kaunas Fortress, the task of the research was formed on the base of the statement of the Department of Cultural Heritage under the Ministry of Culture "...on the part of the plot at Kareivinių St. 9, Kaunas, that enters the territory of a cultural heritage object protected by state, construction works that do not damage the valuable properties of the object, are allowed. The new construction needs to be based on historical research, proving that the historic building actually was on the planned site of construction ...".

Article 19(2) of the Law on Protection of Immovable Cultural Heritage of the Republic of Lithuania states that "In an object protected for public knowledge and use, territory thereof, at a site, it shall be prohibited: to destroy or to otherwise damage the valuable properties specified in the certificate of immovable cultural property; in the territory or protection zone, to build the structures likely to eclipse the object or objects of cultural heritage by height, size or appearance and hinder survey thereof; to destroy or damage monument boards, information stands of the immovable cultural property or the boundary marks of the territory of an object or site of cultural heritage". Article 19(4) of this Law also states that "In an object protected for public knowledge and use, the construction operations diminishing valuable properties shall be prohibited: adaptation of the object of cultural heritage for the uses other than specified in the certificate of immovable cultural property; increase of the intensity of the use of protected structures - the building of extensions to buildings, additional floors, the equipment of new mansards, the formation of a new planned structure and otherwise destroying signs of authenticity".

Taking into account the aforementioned conditions, the aim of the research work is as follows: to carry out the historical research, as well as research on the current state and spatial structure genotype, on immovable cultural heritage and ascertain whether: 1. the new building will not affect the valuable properties of the complex, 2. will not obscure cultural heritage objects or their visibility; 3. will not violate the spatial structure of the territory. In response to the aim of the research, the following studies were carried out: analysis of historic - urban development of heritage object; specification and evaluation of current state and valuable properties of the complex; investigation and modelling of changes of spatial structure genotype of a former artillerymen' military town of Kaunas Fortress. The research was based on bottom-up or predictive



IKONOGRAFIJA NR. 7.

Fig. 1. A fragment from a plan of military town of department of artillery and aeronautics of Aukštoji Panemunė ~1912 (РГВИА, ф. 13148, оп. I, д.) [1; Iconography No. 7, taken from N. Steponaitytė' personal archive]

modelling approach while using the Space Syntax models in order to compare past, present and predicted spatial features of the protected urban area in terms of its perception and potential scenarios of space usage. Besides the practical objective to evaluate possible transformations of the investigated object, the research aims to demonstrate and prove possibility to describe valuable features of architectural and urban cultural heritage while using quantitative methods.

Analysis of Historic – Urban Development of the Heritage Object

Aukštoji Panemunė complexes of military buildings. In 1894, the state bought folwarks (similar to small mansions,– translator's note) near Aukštoji Panemunė and Frendzelhof; Mansion of Aukštoji Panemunė and the town itself became the property of the Russian Ministry of War. Originally, military roads were built, and the main street of the town (Vaidotas street) became the military highway. In 1895-1899, three big military towns developed in Aukštoji Panemunė, 73 military objects were built - barracks, houses for officers and administrative staff, warehouses, stables, workshops, cellars, other outbuildings. Construction continued at the beginning at 20th century.

In the territory of former mansion of Aukštoji Panemunė, near Nemunas, a fortress company of pioneers was established. In 1911, the following buildings of the company were marked on the plan: barracks, a warehouse for shells, stables, officers' house, registry and a commander's apartment, sauna with workshops and guardrooms, servants' house with a laundry, and cellars.

The department of aeronautics was being created close to the river Sėmena; it contained barracks, workshops with pigeonry, warehouse for sulphuric acid, warehouse for trains, the house where the head of the department lived (formerly the house where the owner of the manor lived), stables, coal warehouse, smithery, a hangar for lacquering air balloons, reservoir, various warehouses and small buildings. There were also plans to build hangars for airplanes and air balloons, garages for cars, but there were not enough time to implement those projects (Fig. 1). Here, in 1912–1923, the aerodrome of Kaunas Fortress has already been operating. The territory of the aerodrome was on the right bank of River Sėmena, which is approximately, where Birutės street passes now. The aerodrome at that time was simply a flattened meadow.

After World War I, the units of the Lithuanian Army were deployed at Aukštoji Panemunė. In 1936, a motorized anti-aircraft protection team has been created.

A warehouse complex for artillery was established to the northeast of military towns. It consisted of an intermediate warehouse for powder, a warehouse for wet and gun cotton, a drying room, a laboratory, a gendarmes' homestead.

Complex of barrack buildings of Kaunas Fortress Artillery. A large fortress artillery barrack complex was built to the south of Aukštoji Panemunė. The place for artillerists was chosen at the foot of the slope of the Nemunas valley. The slope was supposed to serve as a natural obstacle at the southwest side. The slope was also needed for the installation of shooting-ranges. In the field, which was intended to be a place for a Fortress, on the terrace of an upper valley, on the southeast side of the slope, a large artillery ground with obstacles and trenches was erected. The territory of the polygon extended as far as the Fourth Fort. The field was also intended to be used as one of the aerodromes of the fortress.

The complex was built according to the strict principles of geometric planning, its territory

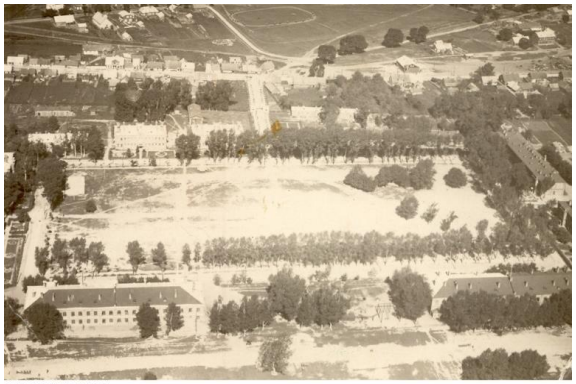


Fig. 2. Aukštoji Panemunė. Barracks of the Great Duke Kęstutis' 5th Infantry Regiment. Kaunas, 20 century, 1920-1930 [2; Iconography No. 11, funds of Vytautas the Great War Museum. Fa-14045]

extended parallel to the slope from the current Plytinė Street to the cemetery of Aukštoji Panemunė. The buildings were being located around a large rectangular square intended for parades-trainings, and near three streets that vertically meet together at that exact place. In the south-west, south and east side of the square a four brick two-storey barracks (that were made of bricks) were built , as well as a guard-house and warehouses for guns; on the north and west side there was doctor's house, canteen, sauna, one-two-storey masonry blocks of flats for officers, with warehouses, cellars and other outbuildings.

A narrow railway line of the Fortress that reached the barracks was built, which passed along the slope of Nemunas Valley from military railway station at Žemoji Freda (near railway bridge over Nemunas) to the north-eastern edge of artillery building complex (almost to the cemetery).

The plan of 1980 lists primary buildings: four barracks, each for 2 companies, canteen with kitchen and pantries, cellar for storing food, house for heads of 8 companies, their stables with pantries, cellar for storing food and officers' laundry. In 1911, the following buildings are marked as present in a plan of 5th horse artillery: a commander's house, officers' house, doctor's house, two storey barracks, guardhouse, small stables, big stables, warehouse for gun carriages, smithery, hospital for horses, house for officers' servants, a cellar, cooling room; stables are also designed, as well as sauna, laundry, emergency warehouses with reserves, woodsheds, cooling rooms, workshops, three houses for the commander of the battalion and young officers, laundry for officers. Two large shooting-ranges were installed, surrounded by terraces.

The complex of the present form and composition only formed on the eve of World War I. As the mobilization was launched, hiding places made of concrete were started to be built on the south side of the complex, on the slope of the valley. The data on how many of them there was supposed to be built was not found, but now the remains of 6 hiding places, which have been blown up, remained.

The buildings of the complex were of red brick, which was made by a masonry nearby. Officers' houses were built with warehouses, cooling rooms. Unlike in Žemieji Šančiai, masonry houses for officers and specialists were built instead of wooden ones. There were no wooden buildings in the entire territory of Aukštoji Panemunė. The facades of officers' houses are decorated with rather sophisticated brick details. The interior was also much more luxurious in comparison with the former military town of Žemieji Šančiai (Fig. 2).

The access roads and yards were paved with outdoor stones, while in Šančiai most of the access roads were paved with soil. As it was written in the press at the beginning of the 20th century, the barracks district in Žemieji Šančiai was known as being untidy and full of dust and mud.

There are drinking water wells and drainage wells in the territory. Water that ran from the slopes, which would run in ditches, and in the lower part would get into drainage wells and pipes, was a big problem. Underground drainage system has not been investigated.

After World War I, artillerymen of the Lithuanian Army settled here, they also enjoyed the natural situation and a ground mounted on top of the slope. During the interwar period there were no major changes, no new buildings were built. The railway was dismantled. During this period, an important building was built – concrete entrance gates decorated with the symbols of the Lithuanian Armed Forces.

In 1940s, the complexes of the Lithuanian Armed Forces throughout Lithuania were taken over by the Red Army.

During World War II, the German Army occupied many buildings.

After the war, the Red Army (later – the Soviet Army) took over again. Then intensive constructions began in the territory. As the tradition was continued here, artillerymen who needed a lot of room for various mechanisms settled here; massive masonry and assembleble concrete hangars were built for tanks and other mechanisms, as well as big workshops and garages. The buildings were placed without much attention to the historic urban structure.

In 1993, after the Soviet Army withdrew from Lithuania, the Lithuanian Armed Forces settled down in the complexes of military towns in Aukštoji Panemunė - a battalion of soldiers deployed in the south-western part of the city, residential houses remained next to the training ground, and the engineering battalion of General Juozas Vitkus settled on the north-eastern side. Many big buildings

of Soviet era were demolished; most of them remained on the very north-eastern edge of the territory.

The Specification and Assessment of the Current State of the Complex and its Valuable Properties

According to the data of the Department of Cultural Heritage, the part of the plot under investigation entering the Kaunas Fortress Artillery complex of barrack buildings is registered in the Register of Real Heritage of the Republic of Lithuania [3]. This part of the complex is marked with symbol "A" and is located in the northern and north-eastern part of the investigated area (Fig. 3). The plot at Kareivinių St. 9 covers not only the protected complex, but also the farming-production zone (about 55%) which is unprotected and belongs to the technical park of the battalion.

Planned spatial layout of the territory. While studying the spatial layout of the territory, two morphological zones of different periods with different morphological types of layout reveal themselves. *Morphological types* are the historically formed parts of morphological zones where the distinctive planned structures of separate historical periods, the spatial compositions and the contingent of authentic, valuable properties that have exceptional properties of cultural value all remained. Part of the territory relevant to the research was formed during the Tsarist period, the other part - in the Soviet period. During the study of the layout of the territory, two morphological zones of different periods were distinguished with different morphological types of layout, where the layout of the buildings built in the Tsarist period is clearly geometrically structured. The layout of the buildings is strict and linear; two axes are formed, first – along the eastern edge of the main square of the complex, the second - going from the western boundary of the site with the reciprocal layout of the inner road. The structure of the layout formed later on, during the Soviet times, is free, formed without regard to the previous layout. These territories of a different period are also different from a functional point of view. The territory of the Tsarist period consists of administrative-residential buildings that define the main residential-community function of this zone. The territory that shaped during the Soviet period has buildings for production and farming, which respectively form the production function of this territory (technical park zone). *The administrative zone of the battalion* is intended for administrative and residential premises used for conscripts' accommodation, feeding, training, conferences and meetings. In this zone, trainings, lectures and cultural events for soldiers are organized. Both heavy (armoured) and passenger cars drive around in the *technical park zone*; the road

Fig. 3. Complex of barrack buildings of Kaunas Fortress Artillery. Explanation: ***A*** *– part of the plot at Kareivinių St. 9 that enters the territory of a protected object Kaunas Fortress Artillery complex of barrack buildings;* ***B*** *– the rest of the Kaunas Fortress Artillery complex of barrack buildings [3]*

infrastructure is unpaved, which is why there are a lot of dust, noise created by working machinery can constantly be heard; the soldiers are trained how to use engineering machinery and equipment, various operational materials are stored.

Visual expression of buildings and their current state. The visual expression of buildings is characterized by the individuality of buildings and the peculiarities of visual properties. The specific layout of the territory is determined by buildings of different periods. It is possible to distinguish three main periods: Tsarism, Soviet and Independent Lithuania. The architecture of Tsarist period enters the protected zone of the battalion and is mainly in the administrative functional territory. The buildings are built from red brick masonry, they are 1-3 storey high, with sloping roofs, the facades are distinguishable by decor and exterior pillars, as well as decorated cornices. The buildings of the Soviet period are built from masonry of white silicate bricks, the facades are without any decor elements, massive volumes and flat roofs can be distinguished. These are mostly garages, warehouses and repair workshops. The intervention of the Independence period is not significant. It is more associated with the renovation of buildings and reconstruction works. Auxiliary buildings such as transformers, etc., are refurbished by using facades of lightweight constructions and painting them dark green, which fit in the natural environment.

The originality and individuality of the territory is formed not only by buildings, but also by plantations and spaces for mass events, intended for outdoor events specifically, that cannot be obscured by buildings and planted with plantations. Other areas of the territory are moderately planted; cosy, semi-enclosed spaces are formed.

The current state of buildings of a complex. The current state is assessed taking into account the general physical state of the building, roof types,

materiality and height. The physical state of the building is evaluated taking into account how worn-out the building is: *Good condition* (the building is renovated or the physical damage that is already done does not exceed 25 %) – G, *medium* (repairs are necessary for the building, physical damage exceeds 50 %) – V and *bad* (structural changes are necessary for the building as it is worn-out by more than 75 %) – B. When assessing the current state of the buildings, the following types of roofs are distinguished: gable roofs - DV, hip roofs – KT and flat roofs – ST. When assessing the materiality of buildings, the following materials are distinguished: historical red brick masonry – RPL, brick masonry – PL, concrete/blocks/slab blocks – BL, mixed constructions – MK. The height is provided indicating storeys including an attic – 2M, or without an attic – 2.

The physical state of the buildings of Juozas Vitkus Engineer Battalion is good; however, the physical state of few of the buildings is mediocre. Both in the administrative-residential zone and in the technical park zone the buildings are being renovated and maintained. The renovation of historic buildings is carried out in compliance with heritage protection requirements, their valuable properties are not violated.

Description of valuable properties of an object. Importance level – regional; status – protected by state; type – immovable; structure of the heritage – complex. The complex consists of: 1. Hospital for horses at complex of barrack buildings of Kaunas Fortress Artillery; 2. Farm building; 3. Smithery; 4. Warehouse for guns; 5. The big stables; 6. The small stables; 7. Building serving other purposes; 8 The first building of the sauna; 9. Stables; 10. Canteen; 11. First warehouse; 12-13. First and second barracks buildings; 14. Fragments of paving in the territory between stables (Tables 1-2). The size of the territory, including adjacent plots, is 229115.00 m2; the nature of valuable properties is architectural (determines the significance, important), engineering (determines the significance, important), historical (determines the significance, important), urban (determines the significance, important).

Investigation and Modelling of Changes of Spatial Structure Genotype

The **aim** of the research is to study in detail the peculiarities of the spatial planning structure, one of the most important valuable properties, of the former Kaunas Fortress military town and to model and evaluate the influence that the building built in the territory of a cultural heritage object will have on the expression of the aforementioned valuable property.

Theoretical background. On a most general level, the theoretical background of the research is formed by the idea of two architectural languages formulated by Christopher Alexander [4] and Nikos A. Salingaros [5]. According to the aforementioned authors, an architectural object has a form and a model that is expressed graphically, called *pattern*. As the form of the object is changing, the ***pattern*** can remain unchanged, and it then is the bearer of genotypic properties of the object, influencing its versatile usage. Using this idea, the research examines the spatial structure genotype of a military town, which is the most important feature of the configuration of spaces, affecting the perception and possible usage of an object.

The choice of a specific spatial genotype research methodology is based on a systematic, complex approach that sees architectural-urban spaces as a network composed of nodes and connections [6; 7; 8]. The space syntax method [9] based on mathematical graph model is used for modelling both architectural-urban and other (social, virtual, etc.) networks. The most important thing when it comes to architectural research is the concept of the centrality of a graph node (it may be street space, public space, urban axis, etc.) which allows to distinguish parts of the system that are the most important from different points of view. Space Syntax Methodology (Bill Hillier, “Social Logic of Space”) is chosen as it is the most developed methodology that focuses on social content of spaces and is adapted to the analysis of visually perceived spatial networks – specifically, a visual graph analysis is performed. During the research, the entire territory of the military town is divided into visual cells of 5x5 m. The model based on the calculation of their centrality is used as the basis for the study.

The classical methodology, when it comes to the analysis of visual graph of space syntax [10], is supported, suggested and tried out by J. Peponis when studying the buildings using the modification of the aforementioned methodology, which links the space syntax rates with the cognitive structure of the system [11]. Obtained rates and their meanings are described in more detail by presenting the results of the research.

Based on the aforementioned models and methodologies, the research looked at the way that the spatial genotype of the entire military district of the former Artillery Division (including the part that belonged to the Lithuanian Armed Forces) has changed from the day it was built until nowadays and how it would be changed by the emergence of an auxiliary building.

Methodology and work processes. The following graphic materials was used for the research:

- Plan of military town of department of artillery and aeronautics of Aukštoji Panemunė, 1912, РГВИА. ф.13148, оп.1. д.3647 [12];
- The plan created in 1930 of officer courses of

TABLE 1

The valuable properties of the site and the elements recorded in the Register of Real Heritage [created by authors]

Marking	Element, part of the object	Valuable properties, their changes	Photo fixation	The nature of the handling the elements of the object
P1	Planning solutions	Geometric structure of the plan and volumetric spatial composition, which was formed during the Tsarist period. It consists of buildings located along the main paths; the condition is relatively good, part of small buildings has not remained; new buildings were built in the territory during Soviet times.	 P1. The plot of the site shows the spatial composition of the complex and the area under study, the main axes and the layout of the buildings [3]	Planning solutions on the plot partially changed during the Soviet period, after the formation of production-technical zone, having added several buildings to a layout formed during the Tsarist period. The area must permanently be adapted to the needs of this day, minor interventions,without compromising the valuable properties of the area, are possible.
P2	The existing surviving buildings of the Tsarist period, located in the zone of the protected complex	Hospital for horses; farm building; smithery; warehouse for guns; the big stables; the small stables; building; the first building of the sauna; the stables; canteen; first warehouse; first and second barracks buildings.	 P2. The overall view of buildings of the Tsarist period	The volume, height, facades and their decor, materiality, interior layout, building layout composition of protected buildings are to be preserved. The territory is undergoing a renovation of its buildings and improvement of physical state.
P3, P4	Elements of the ground and its surface	Smooth terrain and slope in the south-eastern part of the territory (the condition is satisfactory, TRP, FF No. 53-55, 2013); shooting range (formed relief - pit with slopes from three sides; satisfactory condition; TRP46, FF No. 39-42, IKONOGR 13, 2014);	  P3. Part of the slope; P4 The hollow of the shooting-range [3]	There are no changes in the territory and the whole landscape. The slopes are covered with scanty greenery. The removal of scanty plantations is required.
P5, P6	Tracks, roads or their parts, coatings	The track from the square in the north-eastern direction; paving fragments in the area between stable buildings; stairs to slope.	 P5. The main fragment of the track of the complex [3]  P6. The remaining paving fragment [3]	The linear structure of the paths formed during the Tsarist period was partially changed during the Soviet period. Later, the structure of the side paths partially changed in the territory relevant to the research, without affecting the structure of the valuable construction of the territory. Possible improvement of the physical state.

CONTINUATION TABLE 1

P7	Greeneries and plantations	The nature of the afforestation of the north-west and south-eastern sides of the square with double rows of deciduous trees; fragments of a tree avenue in Kareivinių St., in a section from the square towards Vaidotas St.	 P7. Valuable complex greeneries have survived [3]	There are no valuable plantations or greeneries remaining in the area relevant to the research.

TABLE 2

Analysis of the current state of the objects that do enter the territory of the protected complex and the description of repair works [created by authors]

Marking	Element, part of the object	Current state of the object and possible changes	Photo fixation	The nature of the handling the elements of the object
P8	Spatial planning structure of the farming-technical zone	Structure of the plan and volumetric spatial composition, which was formed during the Tsarist period. It consists of warehouses, garages, auxiliary buildings (the physical condition of which is good and/or relatively good); the spaces and paths formed during Soviet times do not correspond to the spatial plan composition of the Tsarist period.	 P8. General overview of the farming-technical zone [authors photo]	In the farming – technical or technical park zone, renovation and reconstruction works are possible. There are no valuable properties in this area.

Vytautas the Great and districts of the Military School. Storage location – LCVA (Office of the Chief Archivist of Lithuania). Taken from N. Steponaitytė' personal archive [13];

- Data from Open GOS (buildings and roads). The latter data formed the basis for the information of the historical spatial plans [14].

As already mentioned, the whole territory of the cultural heritage object is examined as one complex which can be accessed during special tourist-visitor programs, regardless of the fact that the territory is currently divided between several owners.

To transform GIS data into dxf format ArcGIC software is used. Further studies were performed using the DepthMap, a program for spatial syntax analysis.

While converting the plan of open spaces into a graph, the entire territory was covered with a grid of 5x5 meters, dividing the territory into visual cells of 25 square meters, which turned into graph nodes. The graph nodes were connected to one another only when they could be seen from one another.

During the analysis of the visual graph, the indicators, that describe the cognitive structure of space and allow to evaluate its changes, were obtained and used for modelling:

- Connectivity is the number of nodes visible from the node.
- The area visible directly from each cell (*Direct purview (DP) = connectivity + 1)*25m^2*). This rate allows to compare systems of the same size or system changes without changing the size of the visible open space. As one or several buildings built in Panemunė military town would not change the overall layout of the site very much, this rate can be used but its normalization would further increase the accuracy of the study.
- Relative directly visible area (*Relative purview*) is the ratio between the *direct purview* and the area of open spaces of the entire object. This rate performs the normalization of the numerical value of the field that is directly visible.
- The closest distance from each cell to all the other cells that is not affected by the presence of other buildings in the territory *(Metric mean straight line distance)*
- The shortest distance from each cell to all other cells, that is affected by distortions of visual

boundaries formed by buildings *(Metric mean shortest path distance)*

- The relative elongation of the shortest paths from every cell to all the other cells *(Path elongation = DepthMap metric mean shortest path distance − DepthMap metric mean straight line distance).* As in the previous case, this indicator normalizes the values of the previous two indicators, making it possible to compare systems of different sizes.
- The average number of turns that needs to be done while moving from each visual cell to all the other cells *(The average number of turns needed to reach other tiles or Mean turns = DepthMap visual mean depth − 1).* According to the space syntax theory, changing the direction of movement is one of the most important steps in shaping the mental map of the environment and orienting in it.
- Path length in meters from one change of direction to the next *(Path length per turn = mean metric path distance/the mean number of turns for each tile).*
- The cognitive framework consists of ten percent of the visual cells that have the largest *direct purview* meanings.
- Having determined the aforementioned rates, coefficients of *differentiation* and *distribution* were calculated, which can be considered as generalized numerical rates of visually perceived space genotype − its "fingerprint". The differentiation is calculated by dividing the average DP value of the cognitive framework by the average DP value of all cells. The higher the rate, the more different the cognitive framework actually is from the overall of the rest of part of the system when it comes to the possibilities of visibility. The distribution is calculated by dividing the average number of turns of cognitive framework cells from the total number of turns. The higher the value obtained, the greater the difference between the cognitive framework and the average visibility of the remaining visual cells from any point of the system; the latter is measured by the number of turns.

At the end of the study, a comparative table was created with the maximum, average and minimum values of all the aforementioned rates. The wider explanation is provided by describing the results of the research.

Results: Situations of 1912, 1930, 2016 and a forecast. Situation of 1912

Maximum area of directly visible visual space – 80925 m^2, average – 46716 m^2, minimum – 150 m^2. The total area of empty space without buildings in the territory is equal to 6963x25 − 174075 m^2. Although the best way for the established rate to reveal the specifics of the object under study would be to compare it to other objects, it is now possible to say that the territory of the military town is of high visibility and the layout forms "perforated" walls that do not reduce visibility too much. It is interesting that the cells that have the biggest visual values are located in a square that was formerly used from trainings. Essentially, this is due to the aforementioned layout of the square, which allows to see not only two main axes, but also spaces behind the buildings − a specific feature of the local architectural-urban genotype (Fig. 5).

The relative area of the directly visible space is counted by dividing the directly visible area of every point from the total area of free space. The maximum value that was obtained is 0.46, the average one is 0.27 and the minimum − 0.0009. This means that 46 percent of the whole territory can be seen from the points that are marked in red; on average, 27 percent of the territory are visible from each point. Thus, the territory, as already mentioned, is clearly seen from any position (Fig. 6).

Figure 7 shows the overall distance that the points can reach (each point from all the other points) in meters. It only evaluates the configuration of territorial boundaries and disregards the buildings that are in it that may limit the movement. Compared to Figure 8, which shows the shortest distances, that evaluate the boundaries for movement that are formed by buildings, instead of straight lines, this rate allows to evaluate the level of spatial transformation created with a specific layout of buildings. It is also worth noting that, regardless of the plan of asymmetrical territorial boundaries, the area with the best accessibility is in the former training area.

When comparing the following pictures, it is evident that the buildings slightly transform the original uncovered space.

This rate is calculated by comparing the distance of a straight line with the real shortest distance (Path elongation = DepthMap metric mean shortest path distance − DepthMap metric mean straight line distance) / (DepthMap metric mean straight line distance). The rate generalizes the rates shown in figures 9 and 10. Its maximum value is 0.105, the average one is 0.02 and the minimum − 0.0008. This means that the maximum deviation from a distance of a straight line when it comes to this territory is 10 percent. Interestingly, the maximum elongation is typical of points of visual field located at the rear facades of the buildings − the representative and auxiliary or household building spaces are separated without using any additional means (Fig. 9).

Maximum value of average number of turns, moving from each cell to all the others, is 2.39 (it is

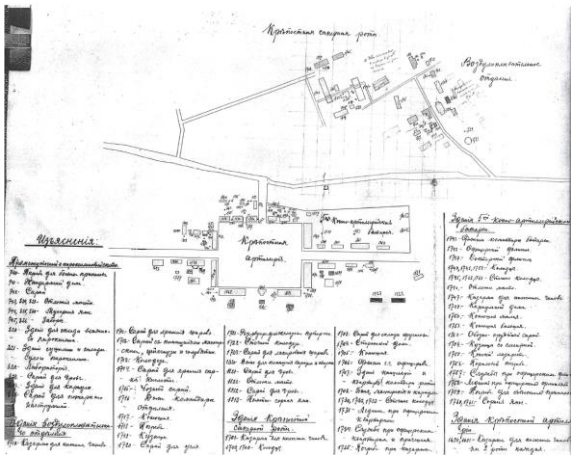


Fig. 4. Plan of military town of department of artillery and aeronautics of Aukštoji Panemunė, 1912 [1; РГВИА. ф.13148, оп.1. д.3647]

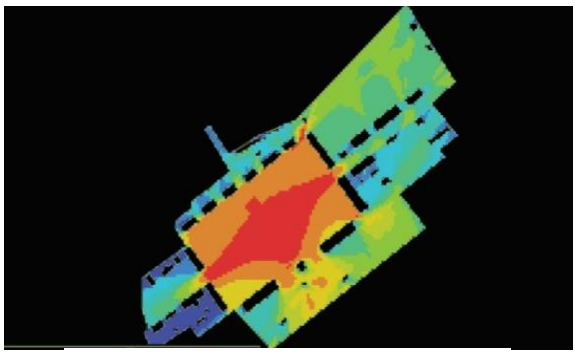


Fig. 5. 1912, directly visible area (direct purview). Explanation: Color red indicates maximum values, color blue – minimum values [made by author K. Zaleckis]

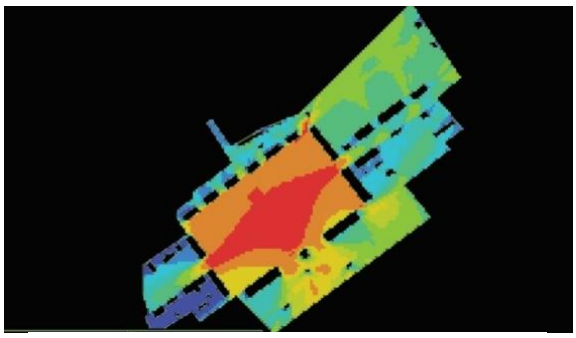


Fig. 6. 1912, relative directly visible area (direct purview). Explanation: Color red indicates maximum value, color blue – minimum ones [made by author K. Zaleckis]

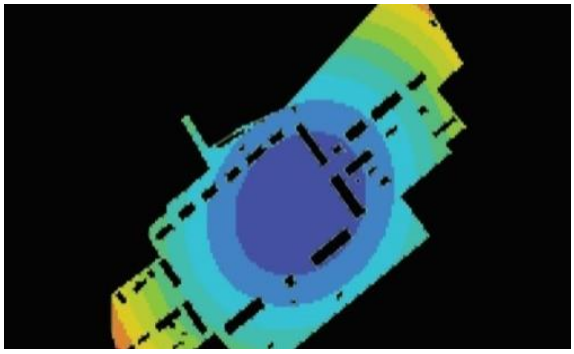


Fig. 7. 1912 Average distance of the straight line in meters. Explanation: color red indicates maximum values, color blue – minimum values [made by author K. Zaleckis]

not a whole number because the rate is calculated by dividing the sum of turns necessary to reach each point from any point from the total number of points). If compared to the other objects investigated using the Space Syntax Methodology, the military town in question is a very shallow structure, which shows a possible close integration/interaction between the functions of certain spaces in this town and a high degree of visual integration (Fig. 10).

The rate is calculated by dividing the average distance between the points from the average number of turns (Path length per turn = mean metric path distance / the mean number of turns for each tile). The maximum value that was obtained is 496 metres; the average value is 332 metres and the minimum - 136 metres. It is important to emphasize that this is an average distance, i.e. it is summed and divided from the number of graph connections for each point-cell, and not the real maximum and minimum distance. In the first case, it would reach about 750 meters - i.e. the length of the longest axis of the object, in the second case - about 15 meters, i.e. the length of the distance between some buildings and the territorial boundaries. These rates will be important when modelling the changes of the object under study in the course of history; it would make it possible to compare the Panemunė military town with other similar objects of Kaunas Fortress and to determine its unique characteristics (Fig. 11).

The cognitive framework of the territory consists of 10 percent of visual space cells that have the greatest values of directly visible spaces (Direct purview). The unique property of town genotype is a cognitive framework that forms a rhombus shape, whose configuration and domination are determined by a perforated perimeter layout and good visibility from each space (Fig. 12).

Two summarized rates of visually perceived space genotype are the coefficients of differentiation and distribution.

Coefficient of differentiation (*mean DP overview / mean DP all*) = 74383/46717=1.592.

The greater the value of differentiation, the more different the cells making up the cognitive framework are in comparison to the rest of the visual cells.

Coefficient of distribution (*mean turn number for overview /mean turn number for all nodes*) = 0.587/0.822=0.714.

The higher the value of distribution, the greater the difference between reach/accessibility/proximity from any given point to the cognitive framework and the average point, measuring by changes of direction-turns.

Situation of 1930

Maximum area of directly visible space is 81325 m^2 (it increased compared to 1912), the average area

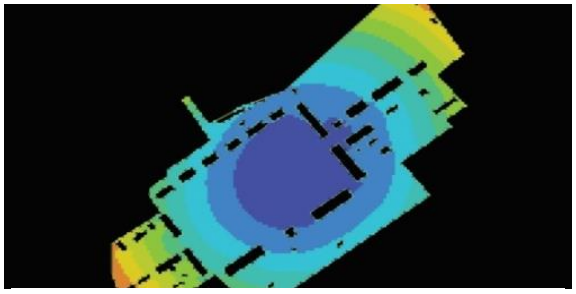


Fig. 8. 1912 Average shortest distance in meters. Explanation: Color red indicates maximum values, color blue – minimum values [made by author K. Zaleckis]

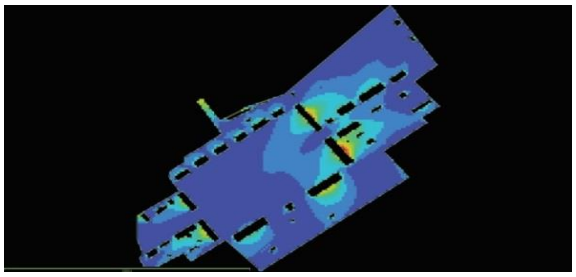


Fig. 9. 1912 Path elongation. Explanation: Color red indicates maximum values, colour blue – the minimum ones [made by author K. Zaleckis]

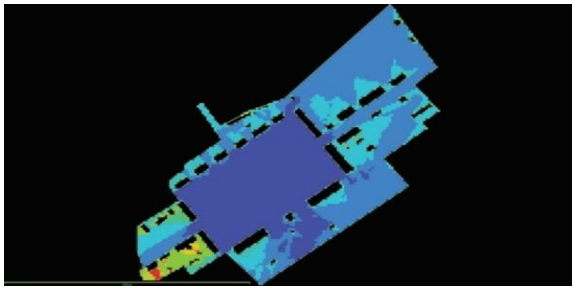


Fig. 10. 1912 Average number of turns to reach all points from any point. Explanation: Color red indicates maximum values, colour blue – minimum values [made by author K. Zaleckis]

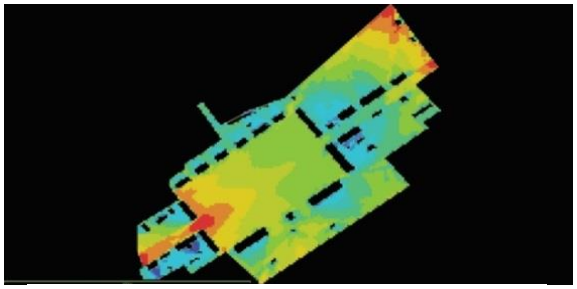


Fig. 11. 1912 Average length of a straight line between the turns. Explanation: Color red indicates maximum values, color blue – minimum values [made by author K. Zaleckis]

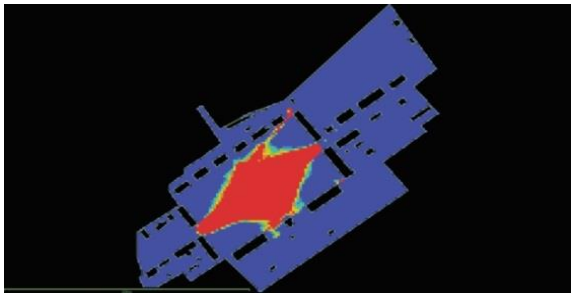


Fig. 12 1912 Cognitive frame of the territory (marked in red) [made by author K. Zaleckis]

Fig. 13. The plan created in 1930 of officer courses of Vytautas the Great and districts of the Military school. Storage location [19; LCVA (Office of the Chief Archivist of Lithuania). Taken from N. Steponaitytė' personal archive]

– 44499 (slightly less than the previous situation), the smallest area – 150 (remained the same). The total area of an open territory without buildings decreased because of the construction of new buildings. It is 6918x25 – 172950 m^2. The differences between the rates are not very significant, but the normalized rates will allow to evaluate them more accurately.

The maximum rate of a relative directly visible area is 0.47, the average value is 0.26 and the minimum value is 0.0009. It shows that 47 percent of the territory can be seen from the visual points with the highest values of direct visibility, when on average 26 percent of the area in question can be seen from each point. In both cases, when comparing the situations of 1912 and 1930 the change is one percent respectively.

The distribution of a metric straight line and the absolute values of the shortest distance in the territory does not reveal any differences when it comes to the visual comparison between the situations of 1912 and 1930.

The maximum value of straight path elongation – 0.108, the average value is 0.02, and the lowest is 0.009. This means that the maximum elongation of the road is 10 percent and the average is two percent. The rates have not changed substantially compared to the previous situation.

The maximum calculated average value of turns when they move from each point to all the other points remains the same, i.e. 2.39, if compared to the situation of 1912.

Maximum average length of a straight section is 493 m (decreased by 3 meters in comparison with 1912), the average length – 324 m (decreased by 8 meters) and the minimum is 136 m (remained unchanged).

As in the situation of 1912, the cognitive framework of a territory in question consists of a rhombus in its centre (former training ground). Coefficient of differentiation 74704 / 44999=1.660. Coefficient of distribution – 0.581/0.843=0.689.

A slightly more significant change is shown by the coefficient of distribution, which means that the cognitive framework has become slightly less accessible compared to the previous situation, however the change is not substantial.

Summing up the situations of 1912 and 1930, it can be said that the visual-cognitive genotype of the area under study remains unchanged, and the insignificant changes in the rates that describe it, probably together with the situation of 2016, further define certain indicative genotype changes.

Situation of 2016

The maximum value of a directly visible area is 76575 m^2, the average value is 44467 m^2, the minimum – 225 m^2, and the total area of the territory in question is – 174375 m^2. There is a slight decrease in maximum and average values, but the change in both cases is about 5 percent if compared to the situation of 1912. The relative change in these rates will be revealed by further research.

The maximum value of a relative directly visible area is 0.44, the average value is 0.26, the minimum value is 0.0012. This indicates that during the Soviet period and in the interwar period the maximum area that can be directly visible in the territory in question shrunk by 2 percent, and the average visible area ‑ by 1 percent. As already mentioned, it is not a major change that indicates the mutation of genotype. Instead, it is a slight extension of variability. The latter statement can be based on space dimensions defined by Bryan Lawsan according to the nature of its social use: personal, social and common space. The latter can also be categorized according to the visual distance of recognizing another person (Bryan Lawson, "The Language of Space"). In all cases, changes of the characteristics of spaces do not transfer them from one category to another.

The visual assessment of the results of research related to the straight line and the shortest metric distance revealed that the changes are unnoticeable if compared with the situation of 1912 and 1930.

The maximum coefficient of the elongation of the shortest path in the territory, if compared with the undeveloped territory, is 0.101, the average ‑ 0.02, the minimum ‑ 0.008. This shows that, despite some minor changes in the rates discussed previously, the degree of initial transformation of the spatial structure of the territory from the open space to the space limited by buildings remains unchanged. The average maximum number of turns while moving from each point to all the other points in 2016 is 2.15. The maximum value of a straight line between the turns is 507 metres; the average value is 330 metres and the minimum ‑ 128 metres. As in previous cases, a certain slight change, compared with the situation of 1912, can be noticed,

Fig. 14. Research object: territory and its environment in 2016 (google.com/maps) [20]

but it is not crucial to both the genotype and the urban phenotype and, according to Bryan Lawson' spatial characteristics, that are important to its use in a social context, it did not create a significant change.

The cognitive framework of the territory remains unchanged compared with 1912 and 1930.

The summarizing coefficients of differentiation and distribution also do not show any significant changes in the territory, and if the attention is paid to micro changes - they become even closer to the primary situation of 1912 (if compared with the situation of 1930). Coefficient of differentiation = 70537/44648 = 1.580 (1912 ‑ 1.592, 1930 ‑ 1.660). Coefficient of distribution = 0.599/0.821=0.730 (1912 ‑ 0.714, 1930 ‑ 0.689).

Predicted situation. The predicted situation differs from the existing one in one newly designed building. When the aforementioned building was built in the territory relevant to the research of a directly visible area, the biggest value would be equal to 76550 m^2, the average ‑ 43957 m^2, the minimum ‑ 200 m^2, and the total area of a territory under investigation would decrease to 6920x25 ‑ 173000 m^2. Compared to the current situation, the changes are insignificant and even smaller than the ones that occurred in both 1912‑1930 and 1930‑2016.

The relative radius of a clearly visible territory after the construction of a new building will not essentially change compared to the situation of 2016. Its maximum value would be ‑ 0.44 (unchanged), average ‑ 0.25 (decrease by 0.01), minimum ‑0.00111 (decrease by 0.0001). This suggests that the average area of the direct visual field that can be seen in the territory was reduced by one percent. This is a small change which, given the fact that the cognitive framework of the territory is formed by visual cells of the territory with the highest values in regards to directly visible field that are at the centre of the territory, could be allowed to be bigger.

The visual assessment of the results of research related to the straight line and the shortest metric

TABLE 3

The most significant changes that occurred and that are thought to occur later on in regards to the rates of visual genotype of an analysed territory [created by authors]

Rates	Values	1912	1930	2016	Prognosis
Total space of a visual field	m^2	174075	172950	174375	173000
DP	m^2, maximum value	80925	81325	76575	76550
	m^2, average value	46716	44499	44467	43957
	m^2, minimum value	150	150	225	200
Relative DP	maximum value	0.46	0.47	0.44	0.44
	average value	0.27	0.26	0.26	0.25
	minimum value	0.0009	0.0009	0.0012	0.0011
Path elongation.	maximum value	0.105	0.108	0.101	0.103
	average value	0.02	0.02	0.02	0.02
	minimum value	0.008	0.009	0.008	0.008
The average number of turns	Times, maximum/average	2.39/0.82	2.39/0.84	2.15/0.82	2.15/0.83
Path length per turn	m, maximum value	496	493	507	493
	m, average value	332	324	330	325
	m, minimum value	136	136	128	145
Coefficient of differentiation		1.592	1.660	1.580	1.601
Coefficient of distribution		0.714	0.689	0.739	0.719

distance revealed that the changes are unnoticeable if compared with the situations of 1912, 1930 and 2016.

Upon the construction of the new building, the maximum value path elongation in the area under study would be 0.103, the average – 0.02, the minimum – 0.008. The numbers reveal that only the path from the "deepest" – i.e. most remote, least visible parts of the territory to all the other visual cells could become longer by a tenth of a percent. In the predicted situation, the average maximum number of turns while moving from each point to all the other points would remain the same as it was in the situation of 2016, i.e. 2.15.

The maximum average length of a straight section between the turns having built a new building in the area under study would be 493 m, the average – 325 m, the minimum 145 m. If these rates were compared with the situation of 2016, the change would be from 5 to 17 meters. Having in mind the size of the space (the longest axis is about 750 meters) and the relative proportion of the changes compared with the values obtained in meters, this is only a slight change. However, the changed rates are approaching the situation of 1930 (493/324/136).

The map of cognitive framework, if we compare it with the situation of 1912, 1930 and 2016, does not show any changes – it is formed by a rhombus in the centre of the territory.

Estimated territorial differentiation rate = 70370/43957 = 1.601

Estimated distribution rate = 0.599/0.833 = 0.719

They both fit into the limits set by slight fluctuations of previous rates.

Table 3 summarizes the data of four situations of territory under investigation.

Summarizing the data of the research presented in the table it can be concluded that the visual genotype of the analysed territory is essentially has not changed from the beginning of its formation. Slight micro changes do not affect either the genotype or the phenotype, and are unnoticeable to the observer moving around the territory. This statement can be supported by different theories and models:

- Nikos A. Salingaros' researches of differences when it comes to scales perceived by people [5], in which he discusses how objects of different scale, or, in our case, of different size, are perceived, when their relative difference exceeds the number *e* - 2.17. The quantitative changes of the genotype that were found do not come close to this rate.
- On the grounds of the conception of generalized (that are not divided into visual cells, as it is the case with this study) perceptual sequences of visual spaces (serial vision) formed by buildings, as formulated by G. Gullen (Concise Townscape). According to the aforementioned theory, the perception of an urbanized area takes place while moving from one space to another. In this case, what is the most important is the sequence of the most generalized spaces, their sizes and visual relations with each other (i.e. visibility). The quantitative changes of spatial structure that were found do not exceed several percent and does not change the visually perceptible properties of the spatial structure.
- Bryan Lawson's theory on the language of space (The Language of Space) and the relationship between space dimensions and their social uses. According to the aforementioned theory, open (e.g., Urban) spaces, depending on their

distances, can be divided into private, social and public spaces. The latter can be divided according to another person's face recognition distance. According to this model, the changes of spatial dimensions are very slight and thus do not change their nature.

Discussion

Architectural and urban cultural heritage could be seen as an important formant of built environment from many both theoretical and practical perspectives, e.g.:

- Michael Cole in his theory of cultural-historical psychology proposes concept of outer collective consciousness as an important formant of cultural behaviour [15]. Collective consciousness, according to him is stored and transferred through cultural artefacts which could be described as ideal and material at the same time. From this point of view cultural tangible heritage could be seen as an important cultural artefact.
- If, according to theory of semiotics, build environment is treated as a cultural text, then objects of cultural heritage could be seen as a symbols which make history readable or living now.
- In general terms, from th perspective of genius loci cultural heritage could be seen as an important assest of urban identity.
- If cultural dimension of sustainable urban development is considered – one of the straight forward ways to address it goes through integration of cultural heritage into contemporary urban fabric.
- Immovable cultural heritage could be seen as an important immovable property market layer and catalyser of neighbouring property values [16; 17]; etc.

The above mentioned theories and approaches illustrate the multifunctional potential of tangible heritage which might be utilised only if heritage is actively used in existing contemporary contexts. Such a need quite often creates a contradiction between need to preserve and need to adopt to new functions and changes. As the main tool to assure preservation of cultural heritage in Lithuania is seen a list of its valuable features, e.g. spatial structure, architectural composition, elements of deco, etc. The problem lays in the fact that the above mentioned valuable features are just named thus allowing a big freedom of interpretation if certain valuable features is affected or not in certain situation. Quantitative evaluation of the valuable features and focus on its genotype instead of phenotype might be seen as more objective ways to evaluate transformation and evolutions of historical architectural objects. Different approaches could be mentioned and tested in this situation, e.g. fractal analysis of the facades and spatial structures [18], mathematical description of patterns of architectural forms [5], etc. Space Syntax based approach, which was demonstrated in the presented research, at least in a case of analysis of spatial structure, proves it effectiveness in a precise case and big potential for further exploration.

Conclusions

1. The urban structures of territories of military building complexes formed until the World War I; only the southwestern part, where the Military School was established in the interwar period, was redesigned and the first stadium for military use in Lithuania as well as a new military school building were built. In Soviet times, large new buildings were built in various parts of the territory. Then, in the north-eastern part of the territory in question, a lot of storage facilities of different volumes for large vehicles were built, and they still are at the same place to this day. The farming-production and administrative-residential zones have formed.

2. During the study of the layout of the territory, two morphological zones of different periods were distinguished with different morphological types of layout, where the layout of the buildings built in the Tsarist period is clearly geometrically structured, the layout of buildings is strict and linear, and the structure of the layout formed during the Soviet times is free, formed without regard to the previous layout.

3. The territory of the battalion is divided into two different functional areas: administrative-residential and technical park. It clearly defines and indicates the functional purpose of those buildings, depending on in which of the functional zones of the territory they are. Garages, workshops, warehouses, gas station and other objects are in the technical park area. Administrative-living zone of the battalion is dedicated to trainings, accommodation, conferences and other objects of public-administrative purpose.

4. The visual peculiarity of the territory is determined by the architectural expression of buildings of different periods: materiality, volumes, decision related to colour, etc. The results of the research suggest that the physical expression of the building that will be constructed (materiality, decision related to colour) should match the buildings that were renewed during the period of independence. The physical state of buildings of the Tsarist period is either good or average. Buildings are being renovated and maintained, without compromising their valuable properties. The physical state of buildings of the Soviet period is good, with the exception of a few buildings, as their state is only average.

5. The valuable properties of the territory and the nature of their handling: the existing remaining layout of buildings of the Tsarist period is valuable and registered in the Register of Real Heritage of the Republic of Lithuania. The renovation of buildings and an improvement of their physical state is taking place in this territory; paths, roads or their parts.

6. The investigated area is characterized by an interesting spatial structure genotype – despite of the square and street junction model often found in urban structures, which, at first sight, is typical of the territory; its spatial structure is composed of closely interconnected spaces that can be seen very well when looking from one to another.

7. The spatial cognition framework of the territory is centred on the "rhombus" shaped territory of the former ground for training – such a focus is determined by the perforated perimeter of the square and street. It is an exceptional property when it comes to this territory that is unlikely in other urban complexes.

8. In the territory in question, using only minimal means (basically, only the layout of buildings) representative, household or more "private" spaces are separated – it is a good example of masterful planning.

9. The specific cognitive framework configuration of the territory is determined by perimeter layout with spaces between buildings. It is very important to preserve the latter property of layout in the future, as any change can cause a modification of spatial structure genotype.

10. The study of the territory was carried out taking into account its historical boundaries and its cognitive/architectural potential, which, as the territory is shared by several users, is not readily accessible to outsiders. We recommend the management of Juozas Vitkus Engineering Battalion to take an active part in the activities of the Kaunas Fortress Regional Park and to provide visitors with a chance to get to know the part of the territory of Panemunė military town that it manages, during sightseeing tours.

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Kopsavilkums. Pētījums strukturēts trīs daļās: vēsturiskās pilsētvides attīstības mantojuma teritorijas izpēte, pašreizējās situācijas analīze un teritorijas telpiskās struktūras izmaiņu izpēte un modelēšana. Rakstā iegūtie rezultāti parāda un atspoguļo kultūras mantojuma objektu vērtību, sistēmas ierobežojumus un iezīmē iespējamo situācijas uzlabošanas veidu.

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Transformation of the Historical Street Settlements and Structures of the city of Jelgava / Mitau in the Post-War Years

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Abstract. Jelgava, as the former capital of the Duchy of Kurzeme and the times of the province, was vividly characterized by a strong German environment, which made a financially strong contribution to the city's economic prosperity. The urban construction period of the city from the beginning of the 19th century marks 4 distinct periods: wooden settlements and buildings until the first half of the 19th century, masonry structures until 40s of the 20th century; implementation of standardised projects (large reinforced concrete panel buildings) from the 50s to the 80s of the 20th century; trends for free-planning construction in the shift of 20th / 21st centuries.

The aim of the research is to evaluate the transformation processes of Katolu and Pasta streets in Jelgava urban planning space within the last century. Research assignments: comparing the change in the height, scale and structure of the historical pre-war and post-war buildings of Pasta and Katolu streets; changes in dominants of the St. John's *[Sv. Jāņa]* church; synthesis of preserved historical buildings in post-war settlement and construction.

Keywords: street re-planning, building dismantling, urban planning structure, urban planning space

Introduction

The rapid boom of masonry buildings in Jelgava at the turn of the 19th/20th century and its architectural and artistic values disappeared with the Russian military aviation air strikes on the city carried out in year 1944. After the bombing, only a few walls of undamaged tenement houses in the central part of the city stretched like separate giant fingers against the sky. These were located along Akademijas, Pasta, Katolu, Svetes, Uzvaras, Dobeles streets.

In the 1950s, next to the undamaged historic houses, new construction began with a different understanding of the urban scale, emphasizing the political power of the time. The gaps along the streets began to be filled by shops, but also by typical residential buildings, schools, hospitals, 2-storey office buildings. The post-war construction, which grew instead of the burned buildings, did not preserve either the historically determined street construction line, nor the height. The new buildings were moved away from the street, thus avoiding the existing stone foundations, which would create uneven structural setting (foundation/underlying layer compaction) of the buildings. Knowing the collapse of the economy after the war, it was easier to dismantle and remove the ruins, but to leave the foundations of giant granite blocks in the ground, levelling and covering them with black compost earth, and planting trees and bushes on the surface. In this way, the orderliness of the urban environment was restored cheaply and on a visually acceptable level, and the places of war-burned buildings were disguised. Planting materials were obtained at the forest edges, namely – lindens, chestnuts, oaks. Especially popular were fast-growing aspens, white alder and poplar, the branch of which quickly covered the plaster of the scarred buildings carved by the war. Before the war, the streets of the central part of Jelgava were made without tree plantations [9]. Some of the newly built buildings were built in the former courtyards, where construction had never existed.

The second solution in the post-war urban planning was to change the street beds, which were moved away from the foundations of the burned buildings at a flat angle, but the old cellars were filled with ruins. The newly created wedge-shaped areas were built as street driveways or pedestrian areas, or by adapting them to the lanes with planted greenery. The consequences of the irresponsible solutions of the post-war years still cause a headache for the city municipality, as the different base of the ground creates uneven sedimentation (compacting), cracks and debris. These factors are due to levelled ruins, filled-in cellars, non-removed stone foundations – like a giant donkiotic struggle with wartime breath. In the underground of the city, it still breathes and makes itself noticed.

The study uses a comparative method based on information from archive materials and the current situation in urban planning of the city of Jelgava. A comparison of the historical and modern building territories of two streets – Katolu and Pasta streets – has been carried out [11].

Results and Discussion

In the graphic image (Fig. 1), using the aerial photography of 1930s, buildings ar marked that have survived after the war on Katolu and Pasta streets. Both streets are located 130 m from each other, and until the 1950s ended at the former Valnu street,

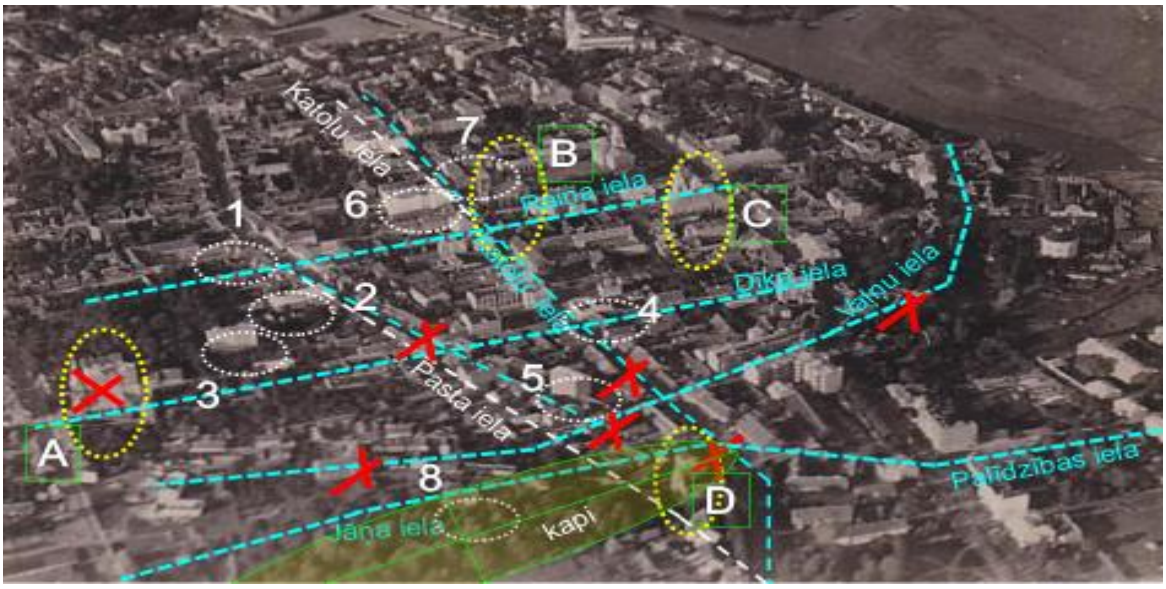

Fig. 1. Preserved historical buildings between Pasta-Katolu-Valnu streets [author's sketch on the map of the 1930s]. 1. Pasta street (Pasta street 14); 2. Russian Society Building (Pasta street 32); 3. Polyclinic building (S. Edzus street 10); 4. Tenement house, Katolu street 19; 5. Tenement house, Pasta street 53; 6. Tenement house, Katolu street 10; 7. Tenement house, Katolu street 9; 8. Graveyard Keeper's house, Jana iela 1. The scheme shows churches with an oval circle – from left: A – St. Nichola's [Sv. Nikolaja]*; B – St. Yuri's* [Sv. Jura]*; D – St. John's* [Sv. Jāņa]*; C – St. Ann's and St. Simon's* [Sv. Annas un Sīmaņa]*; Red crosses mark sections of streets that have been destroyed after the war; the green ellipse marks the levelled historic St. John's* [Sv. Jāņa] *Cemetery, which was destroyed in 1950s*

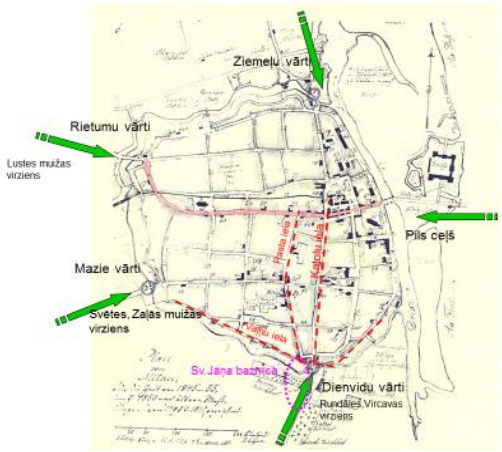

Fig. 2. Historic city gates before the demolition of the ramparts early 19th century

Fig. 3. Cross-point of the Katolu – Pasta – Valnu streets near the former Ann's [Annas] (Southern) ports. Nearby, St. John's [Sv. Jāņa] church with the graveyard is located. Late 19th/Early 20th century Jelgava State Musuem [JVM]

close to St. John's [Sv. Jāņa] church, creating a dominant point for both streets in the southern part of the city, both visually and functionally. The continuation of Katolu street was still in the direction of Lithuania – Eleja and Augstkalne, in the period of 1950s. The structure of this town planning was dismantled in the post-war years. The study covers comparisons and transformation processes in the considered urban planning space.

Katolu Street

Katolu street is one of the city's streets, which has lost both its historic buildings and the street bed.

In the post-war years, when removing the ruins of buildings on Katolu street, the development of its construction can be divided into 3 periods:

- Northern part of the street (from Lielā to Raina street) – construction time during 50s-60s of the 20th century;
- The middle section of the street – from Raina to S. Edzus (Dika) street, in the 60s of the 20th century;
- Southern part of the street – from S. Edzus to Jana street, in the 1970s.

Its historical length until the 1950s was around 1200 m. The street started at the old Market Square and reaches south towards Lithuania until the railway tracks [8]. The historical bed of Katolu street from the intersection of Raina Street to the old Market Square in the post-war years has acquired a wedge-shaped 9-degree bevel to form a departure from the old foundations of the buildings. The entire building of the street was demolished, so it was easy to build the new street.

Fig. 4. Intersection of Katolu and Raina streets near St. Yuri's [Sv. Jura] church. Early 20th century [JVM]

This includes the construction period of the so-called Stalin's residential block houses (Stalinkas), which was popular in late 1940s, when these were gradually phased out by the so-called Khrushchev's residential block houses (Khrushchevkas), the construction period of which were the 50s to 60s. It can be seen on the odd number side of Katolu street even today, where the buildings consist of 4-storey residential buildings with one-room type apartments. These are the so-called hen coops (kuryatnik – курятник from Russian). The types of building layout have been preserved not only in the names of the politicians of the time, but also in the psycho-emotional discomfort, accommodating people in a cramped way and making them understand that the time of socialist realism marks an equal distribution of living space for Soviet workers, and that the level of capitalist bourgeois thinking that was characteristic of the dismantled buildings, is unacceptable. This idea was proclaimed by both the constitution of the Soviet state and the Communist Party, which was the "driving, propulsive force" in the development of the new Soviet republic.

These aspects were reflected in the social planning demagoguery of the post-war years in urban planning, in the location of buildings and in the solutions of their façades. Almost 80 years have passed since the beginning of the redevelopment of the city's infrastructure, but it will not be easy to return to the urban environment the semi-historical and socially acceptable aesthetic and functional guidelines [6].

After reading the International Law on the Protection of Monuments (ICOMOS), it is reported that half a century old buildings are gaining the status of a monument. So, the city's post-war buildings are a cultural heritage. This also refers to heritage that marks the intrusion of a foreign political power into the cultural space of another nation. Thus, through synthesis techniques, urban planning must be designed in such a way that the many layers in time and space are functionally and aesthetically acceptable. Gradually, the urban environment will form a structure in which the historical drama of Jelgava buildings can be read [4].

After the war, at the end of the 1940s, in the northern part of Katolu street from St. Yuri's [Sv. Jura] church (architect K. Strandmanis [K. Strandmanis], year 1906) to Liela street (375 m), its location has been changed, sliding the street bed in a slanting manner by 20 - 40 m. At this stage, the newly built Art Nouveau Latvian Society building was dismantled, with only the roof and windows burned out. Here we can draw parallels with the ambitions of political power, which had been played out already in an analogous style in the city 20 years ago, when the new Latvian government dismantled the "focal point" of the German nobility on the Driksa river bank in the 1920s. So the games of political power in Jelgava continued. Thus, only the church and the adjacent 3-storey tenement house on Katolu street 9 have survived in the northern part of Katolu street, and a small fragment of the 3-storey tenement house at Katolu street 10 on the opposite side.

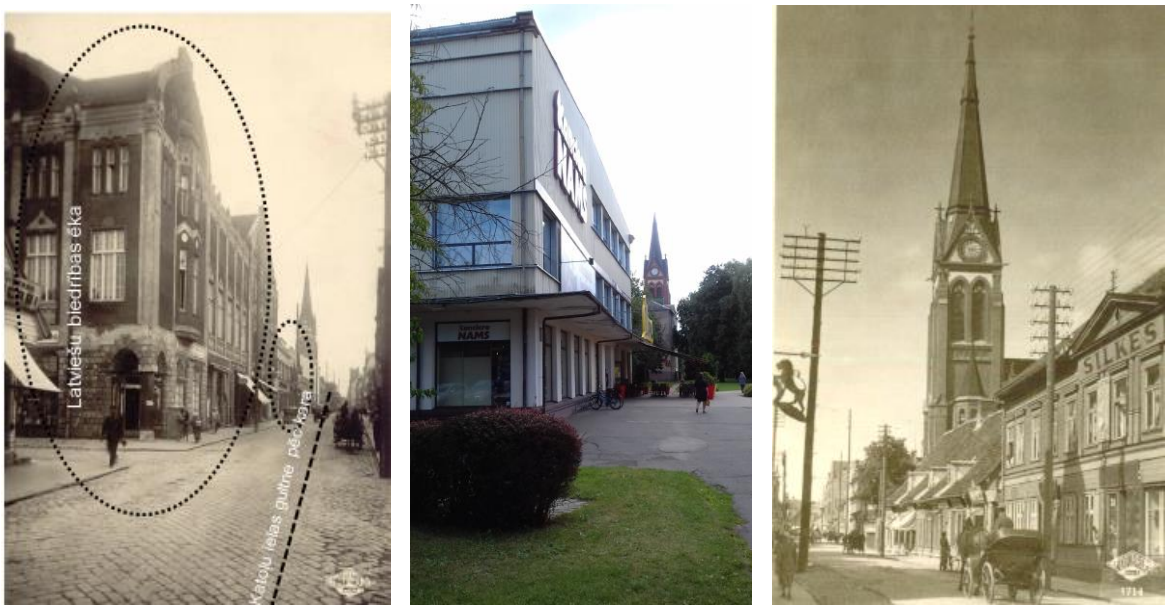

Fig. 5, 6, 7. The northern part of Katolu street, side the odd numbers. Early 20th century [JVM, photo by author, 2020]

A shop was built next to the demolished Latvian Society House in the 1950s, using the dismantled building materials of the Society House.

Like the northern part of the street, the middle section of Katolu street (220 m) from Raina to S. Edzus (Dika) street has lost all its buildings. Only the tenement house at Katolu street 19 was renovated, for which a top floor and a new roof were built in year 1987. A 5-storey residential building with 8 staircases and a length of 130 meters was built between St. Yuri's [Sv. Jura] church and the mentioned tenement house in the 1960s, vividly symbolizing the tendencies of socialist realism in architecture. The imported volume contradicts the structural "canvas" of the urban space and resembles 5-storey barracks. In addition, the building obscures the main lines of view of the St. Ann's and St. Simon's [Sv. Annas un Sīmaņa] church (architect N. Cagins, year 1892), testifying that the political forces of that time were indifferent even to the existence and highlight of the Russian sacred building in the city.

On the opposite side of the mentioned section of the street – a large parking lot – as a message for the destroyed historical buildings along Katolu and Raina streets, which have been accentuating the destroyed historical building area for 76 years.

The southern section of the ruined Katolu street was destroyed in the next decade – during the 1970s, building a grand 5-storey residential quarter instead, and "shortening" the historic street bed by about 260 m. Similar to the middle part of the street, also in this stage it was planned that the new building would obscure the historical dominant – spire of the St. John's [Sv. Jāņa] church. Until the 1970s, Katolu street formed a connection to the Market Square with a highway in the direction of Eleja and Augstkalne, spatially preserving the former Ann's

Fig. 8. Katolu street [JVM]

Fig. 9. The northern part of Katolu street [JVM]

Fig. 10. The northern part of Katolu street [photo by author, 2020]

Fig. 11. The middle section of Pasta Street. In the distance is St. John's [Sv. Jāņa] church and the cemetery [JVM]

Fig. 12. Khrushchev's residential block houses (Khrushchevkas) *opposite the former Latvian Society House [photo by author, 2020]*

Fig. 13. Intersection of Katolu street and S. Edzus (Dika) street [photo by author, 2020]

[Annas] ports site, which existed until the early 19th, when the city rampart (wall) was demolished. The southern part of the Katolu street bed (250 m) has also been removed behind the residential quarter along St. John's [Sv. Jāņa] church. In order to eliminate the dominance of the bell tower of St. John's [Sv. Jāņa] church, entering from the side of Eleja, two grandiose 4-storey office buildings were built next to the church.

In the western part of the church until the 1950s, there was a historical burial area, which was delimited by a forged metal fence with a gate and an entrance to the church from the side of the cemetery. The entrance to the sacristy of the church was from Katolu street. At present, the church is difficult to see in the urban environment, because it is covered perimeter by both the mentioned buildings and the crowns of giant trees. The western side of the former Katolu street with a sidewalk led tightly along the altar end of the church, the fence connecting to the side walls of the altar. The sidewalk was separated by stone posts from the driveway. Next to the altar – the entrance gate to the cemetery, but the entrance to the sacristy of the church was located on the opposite side. The graveyard keeper's house was on the northern side of the burial area next to Jana street. During the 1980s, this was reconstructed. The funeral area today serves as a walking park. Until the war, St. John's [Sv. Jāņa] church was a pronounced vertical dominant in the southern part of Katolu and Pasta streets [2].

Pasta Street

As mentioned above, Katolu and Pasta streets were historically located close together and until the 1950s ended at the former. Valnu street, close to St. John's [Sv. Jāņa] church, creating a dominant point in the southern urban architectural part of the city, both visually and functionally [1; 10].

Before the establishment of a 5-storey residential quarter in the southern part of Katolu street, in the 1950s, an extension of Pasta street through the cemetery of St. John's [Sv. Jāņa] church had already been built in the 1950s, previously dismantling the tombstones which were located there. Thus, the urban structure in the southern part of Katolu street had already been decided sooner and was hidden in the archives under the sign "highly classified".

The northern part of Pasta street from Liela street to Raina street (350 m) has preserved only the post-war post office building at Raina street 14. In the post-war years, several Khrushchev's residential block houses (Khrushchevkas) and a bus station building were built during this period, which is encircled by a large area without buildings. It is an area that was lated cleared of debris, and by planting trees here, it created the so-called bus station square. On the opposite side of the street – dense construction of 4-storey Khrushchev's residential block houses (Khrushchevkas), creating a continuous courtyard area along the northern part of Katolu street. It was the first realized construction of the standard projects (silicate brick houses with reinforced concrete panel mezzanine floors and flat ruberoid-covered roofs), which occupied an area of 1.2 ha in the central part of the city. Both foreigners from the vast Russia, and military personnel, were accommodated in this territory.

At the beginning of Pasta street, a building was built on Liela street for the needs of the militia (Soviet police), which was adapted to the Executive Committee of the City Workers' Union. Behind it, the aforementioned quarter of Khrushchev's residential block houses (Khrushchevkas) is found, which vividly "decorated" the new political power. In the 1990s, three of the buildings were dismantled, building a giant supermarket instead.

Fig. 14. The middle section of Pasta Street [photo by author, 2020]

Fig. 15. The middle part of Pasta Street locked-in inside a courtyard [photo by author, 2020]

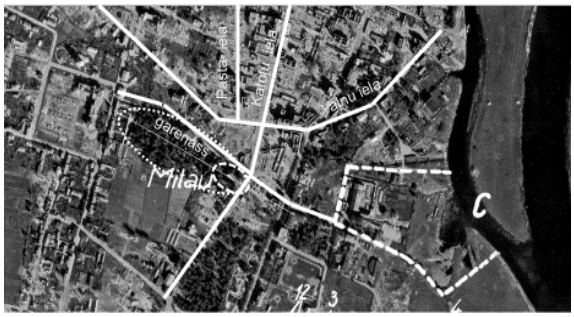

Fig. 16. German army war aviation map. Situation shortly before the bombing of the city in July 1944. Mark on the map "Mitau C" – territory of the city prison. Jelgava State Art Musuem [JVM, author's sketch]

Fig. 17. Former cinema "Zemgale" (architect J. Jaksins [J. Jakšins], 1955.). Built-in dismantled St. John's cemetery granite blocks, well seen in façade of the building; reconstruction of 2016 [photo by author, 2020]

Fig. 18. The middle part of Pasta street [photo by author, 2020]

The middle section of Pasta street from Raina to S. Edzus (Dika) street (220 m) preserves the former Russian Society House (Pasta street 32), and the scenic environment of the former Pauls Garden (Rainis Park).

On the opposite side of the street – former cinema "Zemgale" (Pasta street 47, architect S. Jaksins [S. Jakšins], 1955), a mighty "Stalinka"-type building with massive columns and a triangular pediment. Granite stones were used for the foundations of the building, which were obtained by dismantling the monuments in St. John's [Sv. Jāņa] church's cemetery. The building is positioned further away from the historical construction line. As an argument, the idea of widening the street was used in order to ensure the passage of the future would-be traffic.

Nearby, a large parking lot is located – a place of levelled war ruins of old buildings. A giant square, which is foreign to the urban structure and clearly indicates a disrupted structure of the urban space. The wooden elements of the demolished and burnt buildings were used for heating the stoves in wintertime, but the dismantled bricks were adapted for the construction of new masonry buildings. At this stage of the street, until the 1950s, clock-tower spire of the St. John's [Sv. Jāņa] church could be seen.

In the southern part of Pasta street, in the section from S. Edzus (Dika) street to Jana street (240 m), only the Art Nouveau 5-storey tenement house of Pasta Street 53 has survived. The further section of Pasta street after Jana street leads through the destroyed cemetery (97 m) in the general direction of Lithuania.

The resistance movement in the city ended with repression and manipulation of public opinion, which was practised by the occupying power until the 1980s. The resistance was based on the process of destroying the resting places and monuments of families and popular people, which began in the 1950s. By dismantling of the southern part of

Fig. 19. The lost southern part of Katolu street at the former Ann's [Annas] gate (intersection of Jana and Katolu streets), 1930s [JVM]

Fig. 20. Bell-tower of St. John's [Sv. Jāņa] church [JVM]

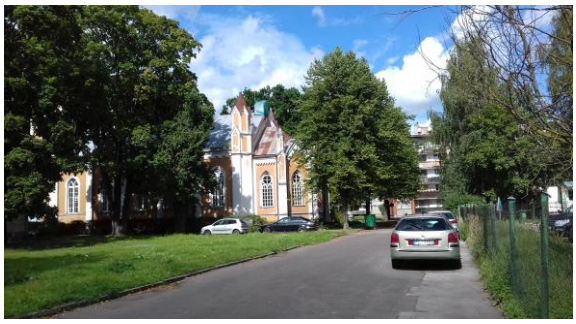

Fig. 21. Bell-tower of St. John's [Sv. Jāņa] church [photo by author, 2020]

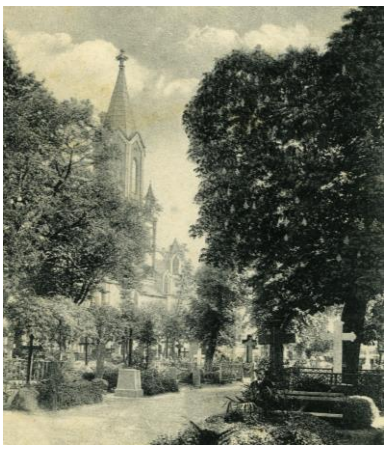

Fig. 22. Bell-tower of St. John's [Sv. Jāņa] church from the side of the cemetery in 1930s [JVM]

Fig. 23. Bell-tower side of St. John's in nowadays [photo by author, 2020]

Fig. 24. Historic buildings at the intersection of Pasta-Stacijas street, 1930s [JVM]

Fig. 25. View to the church from Pasta street [photo by author, 2020]

Katolu street, the overall structure of the urban planning was completely changed [3; 4].

Pasta street in the southern part of the cemetery was connected to the former Lietuvas street, where a 2-storey residential building with a corner tower (Stacijas street 2) has been preserved at the intersection with Stacijas street.

During the 1980s, on the side of even numbers on Pasta street, three 12-storey buildings were placed in the length of 125 m opposite the former cinema "Zemgale", which visually rendered the bell tower of the adjacent St. John's [Sv. Jāņa] church even more diminutive. In its turn, the 5-storey Art Nouveau tenement house at Pasta street 53 was successfully hidden behind the 230 m long building line of commercial buildings and the 5-storey

standard residential buildings. These building areas were acquired for use after the debris was removed [7].

Conclusions

Examining only two of the many historical streets in the southern part of the old Jelgava, and using the comparative method, it can be seen that both streets still have a lot of research to be done in order to find out the exact location of the burned buildings. The study needs to be complemented by information that can be obtained with the help of modern technology, using scanning and photo fixation, and obtaining the locations of historical bases and foundations. The third dimension, or the heights of the buildings, can be read from the very large archive photo collection.

It is impossible to regain the size and volumetric appearance of the completely burned city, but the search for synthesis in the architectural stylistics and functional sense of modern and historical buildings exists. This is especially true of those places where the so-called gaps or undeveloped areas have been retained in street settlements and structures. Katolu and Pasta streets have become very much planted with greeneries in the post-war years. Historically, they were not characterized by substantial tree plantations. This has been facilitated by the creation of areas which were freed from the debris.

The study proves that the nature of urban planning, which developed in the post-war years, is a continuation of the building's contribution to the city's cultural heritage, which in a balanced form and functionality should be transferred to the 21st century and future urban infrastructure, using the latest technologies. The Soviet rule in the period from 1950s to 1980s brought a new scale and understanding of the greatness of Soviet cities, eliminating sentiment about values of cultural heritage. A foreign political position dismantled heritage values or created a disguised structure, as the examples discussed above clearly depict.

The research material is important for promotion of the city's tourism infrastructure, which can be supplemented with information stands, cultural events, etc. The nuances of the city's historical planning and architectural stylistics, and the layering of post-war building trends, can serve well for the development of new infrastructure and business in the city.

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Kopsavilkums. Pētījums par Jelgavas pilsētu pierāda, ka pilsētplānojuma raksturs, kas veidojies pēckara gados, ir apbūves pienesuma turpinājums pilsētas kultūras mantojumam, kas sabalansētā formveidē un funkcionalitātē jāpārnes tālāk 21. gs. pilsētas infrastruktūrā, ņemot talkā jaunākās tehnoloģijas. Padomju vara 20.gs.50. –80.gados ienesa jaunu mērogu un izpratni par padomju pilsētu varenību, likvidējot sentimentu par kultūras mantojuma vērtībām. Svešādā politiskā nostāja mantojuma vērtības demontēja vai arī veidoja maskējošu apbūvi, ko spilgti pierāda iepriekš aplūkotie piemēri.

Pētījuma materiāls ir svarīgs pilsētas tūrisma infrastruktūras veicināšanai, kas ir papildināms ar informatīvajiem stendiem, kultūras pasākumiem utt. Pilsētas vēsturiskā plānojuma un apbūves arhitektoniskās stilistikas nianses, un pēckaru gadu apbūves tendenču uzslāņojums var labi kalpot jaunas infrastruktūras un uzņēmējdarbības attīstīšanai pilsētā.

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Phenomenon of urban boundary in a structure of a city. The case of Vilnius

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Abstract. The article presents a theoretical – fundamental study of phenomenon of physical boundaries in a city and their meaning for the existing urban fabric. The paper draws attention to their different nature and possibilities of integration. In terms of its impact, an urban boundary can be both a catalyst and a tool that forces/stimulates/determines some or other conditions significant in formation of an urban structure. The aim of research is to identify/distinguish these boundaries in a city and see their multi-dimensional character, both in terms of positive and negative impacts on the existing environment. The article studies both the theoretical platform for urban boundaries and the practical works/projects, on the basis of which the laws of urban structure resulting from the perception of physical boundaries and principled solutions to eliminate the negative consequences of these boundaries and to promote positive ones are sought. The article moves from theory to practice by identifying the urban boundaries by means of an experiment, for implementation of which a complex city and then a particular district of it are selected. The city of Vilnius and its district Naujoji Vilnia have been chosen for this role. Vilnius is known for its rich topography, which allows the observation of natural boundaries formed by nature. And the selected district perfectly visualises a merger of different physical boundaries that is interesting in its multi-dimensional character and impact on the structure. The authors study the general extent to which physical boundaries have common points of contact in territories of different scale, what they are, where they are located and how they operate in the local context and what principles could be applied in order to highlight them or diminish their effect.

Keywords: structural boundary of a city, natural and anthropogenic boundaries, urban structure

Introduction

The city is a composite complex combination of elements, some of which, by their dominating nature, determine the peculiarities of the urban fabric structure. The physical boundaries of a city are precisely the element determining the peculiarities of the urban structure. They can be observed on a variety of scales (whole city or its individual districts), which generates different scale effects on the urban fabric, its volumetric spatial expression. The phenomenon of physical boundaries is not unambiguous, and its nature in the city can be both natural (formed by nature) and dictated or created by man (anthropogenic). In particular, the boundaries of the latter nature can be considered as a kind of a phenomenon. The famous German philosopher and anthropologist Immanuel Kant called a thing that can happen by using human experience and knowledge to be a phenomenon. An urban boundary created by man could be considered as such, as it often affects not only the further development of the urban fabric, but also people's lifestyles (form, behaviour, etc.). The boundaries of the urban structure in a city can determine the character of the city, its perception, orientation, etc., sometimes they are chosen as a conscious tool for introducing separation. Often, appearance of boundaries is determined by various circumstances and local conditions: social issues not dealt with (e.g. informal settlements with no pre-design and even no development controls), political sanctions (e.g. the Iron Curtain, the Berlin Wall), economic standards (e.g. business generating clusters, centres), etc.

The topic addressed in the article covers the physical boundaries of cities and their integration into the existing urban fabric of a city, therefore they can simply be called urban boundaries. In terms of its impact, an urban boundary can be both a catalyst and a tool that forces/stimulates/determines different circumstances and conditions for the formation of an urban structure. The aim is therefore to identify/distinguish these boundaries in a city and see their multi-dimensional character, both in terms of positive and negative impacts on the existing environment. The analysis of the phenomenon of the urban boundary uses the following examination route in its recognition process:

To support the study, an illustration of identification of urban boundaries on the city scale and on the district scale is provided. The city of Vilnius and its district Naujoji Vilnia have been chosen for the illustration purposes: Vilnius is known for its rich topography, which allows the observation of natural limits formed by nature; whereas the selected district perfectly visualises a merger of different physical boundaries that is

identification → typology by category and by element → the relationship of the boundary and the environment → potential of the boundary

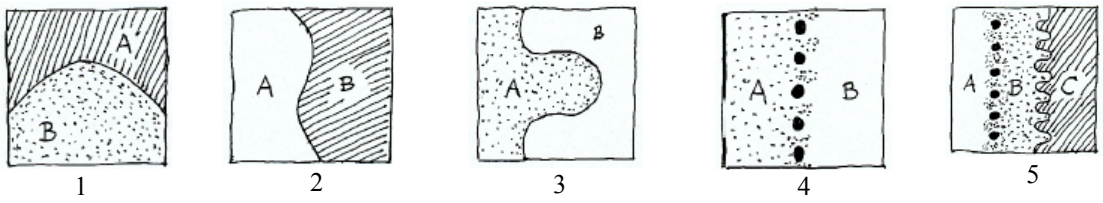


Fig. 1. Structure mergers [1]

interesting in its multi-dimensional character and impact on the structure. The authors study the extent to which physical boundaries have common points of contact in territories of different scale, what they are, where they are located and how they operate. The identification of physical boundaries within the urban structure involves many analysis aspects, and the study of their potential is based on the urban principles and laws of integration into the formed environment, discovered through literature studies.

Study of reference sources analysing urban boundaries of a city

A study of both theoretical and practical works was carried out in the context of studying the phenomenon of urban boundary in the structure of a city, its highlighting, diminishing or even elimination methods.

One of the more prominent theoretical works, explaining existence of a boundary through the method of structural links, is authored by Nikos A. Salingaros, a famous professor of mathematics, a theorist of urban development and architecture. According to him, an urban structure is a system consisting of three elements: nodes, connections and boundaries [1]. All the three elements are important and have their own hierarchy. For their examination, the author uses 8 rules of geometric relations – links, diversity, existence of boundaries, strength (interaction), organization (self-organization), hierarchy, mutual independence and division. According to these rules, Nikos A. Salingaros provides five examples of structure mergers. They can be seen as three-dimensional parts of the city morphostructure (Fig. 1).

They occupy a similar area, are of similar scale, which is illustrative of the first merger rule: only elements of the same scale can merge strongly. A continuous straight line or a pure boundary dividing two districts in a city is rarely found, therefore structures can merge through:

1) contrasting materials or the geometry of the junction (1, 2, 4);
2) the structure boundaries can be interconnected as puzzle pieces (through penetration) (3);
3) structures can connect through the boundary elements (5).

The combination of two elements of a similar scale leads to mutual reinforcement and, when one element is excluded, the other is weakened. The combination of two or more elements makes a whole and grouping, therefore, strengthens the elements, even when one element requires complementing for a stronger connection to exist. The completeness of a structure depends on the strength of the entire boundary, and the aim of an urbanist is to merge different elements into a higher-level structure that acquires new features.

N.A. Salingaros, in his explanation of the strength of a boundary, distinguishes a road as a linear mathematical element shaped by contrasting or different districts. A road through a single area and dividing the area into two similar parts is ambiguous, as it appears that it can be drawn at any point in that space. The road only makes sense when it coincides with the limit of the territory (Fig. 2). Therefore, in this place, referring to the elements of the city distinguished by K. Lynch, N.A. Salingaros states that the stability of the structure is achieved when one element strengthens the other, because otherwise the forces drive the structure out of balance. This means that two urban elements, i.e. the boundary and the road, strengthen each other only by coinciding and merging, and the divided parts of the structures must complement each other and cannot be the same.

The boundaries in the theory of the sociologist urbanist K. Lynch may be weak or strong [2]. The strongest boundaries are those which are not only perceived visually but also intersect movement. The characteristics of the boundaries between different territories describe the character of the city, determine its perception and orientation. The clearest boundaries relate to distinct, continuous natural or anthropogenic elements: river, slopes, railway or highway lines. A boundary has its own character and is easily remembered. Site accesses and nodes are mentioned as a means of highlighting a boundary, which, because of their impact on the boundary, are named as gateways to the city area. The emphasis is also placed on their hierarchy, depending on the characteristics of the elements of place and structure. *Site access* is a particular element (or a group of elements, perceived as an

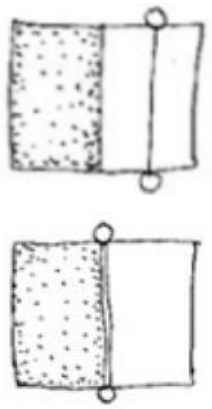


Fig. 2. Structure boundaries and position of a road [1]

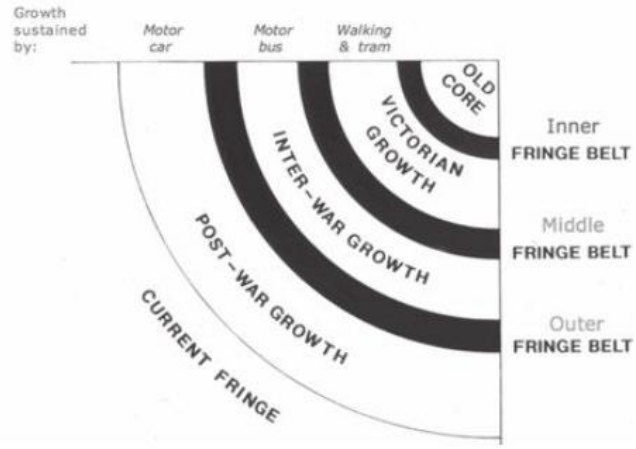


Fig. 3. Models illustrating the city periphery [3]

architectural composition of larger dimensions), which eliminates an obstacle (between building-up of different types). Such nodes may remove a boundary or, on the contrary, they may emphasize it. They capture and demarcate another structure, often becoming spatial reference points for the territory itself.

In accentuating theoretical works on the urban boundary, importance should be attached to the fringe belt method developed by the English morphologist J.W.R. Whitehand and his colleagues, which identifies the distinctive urban structures that formed on the urban periphery in the course of city development, but then have become a part of it over time [3]. The model of examining the urban periphery is based on the idea that a city, as a physical entity, has developed under the influence of a number of growth impulses or alternating stages of rapid and slow growth. Urban periphery belts usually remain for a very long time as underdeveloped zones in the growing urban fabric of the city, so there is a dual aim for such boundaries: either to integrate them smoothly into the surrounding fabric or to highlight them through significant objects in them (Fig. 3). In practice, these areas are also deliberately formed as green belts.

The treatment of a boundary element or phenomenon in the urban structure in the above-mentioned theoretical works further expands the character of the perception and treatment of the boundary. Looking at the positive or negative significance of the urban boundary, it is proposed to act on the boundary itself: if it is a positive phenomenon, it is to be strengthened, if it is a negative phenomenon (kind of a barrier), it is to be eliminated, overcome, etc.

In the case of practical works in the context of the urban boundary treatment, Venice Architecture Biennale 2018 stands out. During it, an exhibition was opened in the German Pavilion to commemorate the 28 years of the fall of the Berlin Wall. The exhibition was called in a very illustrative manner – *Unbuilding walls. From death strip to freespace.* It presents examples of regeneration of the politically and physically divided territory through implemented projects (Fig. 4) [4]. The information of the exhibition is also presented in an illustrative book with the same title. It consists of two parts: (1) the debating part on the Berlin Wall topic with highly touching texts accentuating the consequences of dividing by the boundary; (2) projects that eliminate this physical object from the urban fabric. As the boundary crossed both the natural areas (parks, squares) of the city and the infrastructure corridors and the built-up areas, the projects respect the former character of the territory that existed until the division, continuing the essential characteristics of the rehabilitated accesses. The projects follow the principles of both highlighting and levelling of the boundary, from areas of particular urban intensity to peculiar sites of pause (kind of reflective islands) formed by natural elements of nature within the urban fabric. Although the wall crossed the entire city, projects also address the hierarchy of the parts of the city.

An example of highlighting an urban boundary would be the Cambridge green belt study published in 2002, where an analysis was carried out on various aspects with a view to developing individual urban areas on the basis of this study [5]. One of its parts provides an analysis of the urban landscape and the general landscape where zones or points of the first view of Cambridge were pointed out on the roads accessing the city, from which those arriving to the city can view the city and perceive its size (Fig. 5). The distance and time of arrival from the countryside to a recognizable city area and the expressiveness of access roads are very important elements which give a person the first impression of the city. The Cambridge green belt study roughly grouped the access roads into green or planted with trees, suburban and roads of commercial areas.

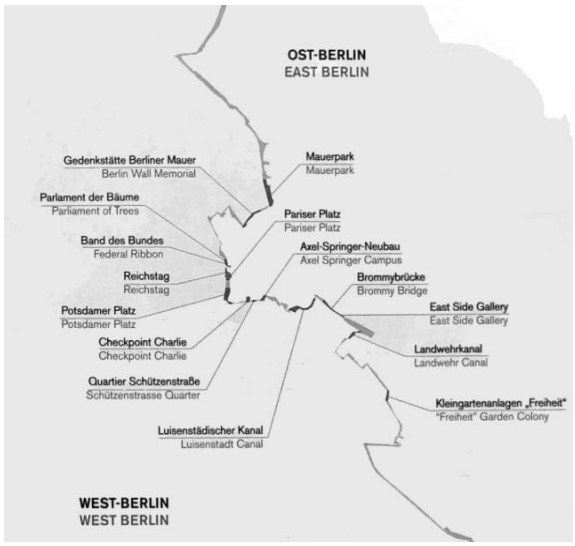


Fig. 4. 26 projects have been implemented along the Berlin Wall trajectory, eliminating this element in the urban structure [4]

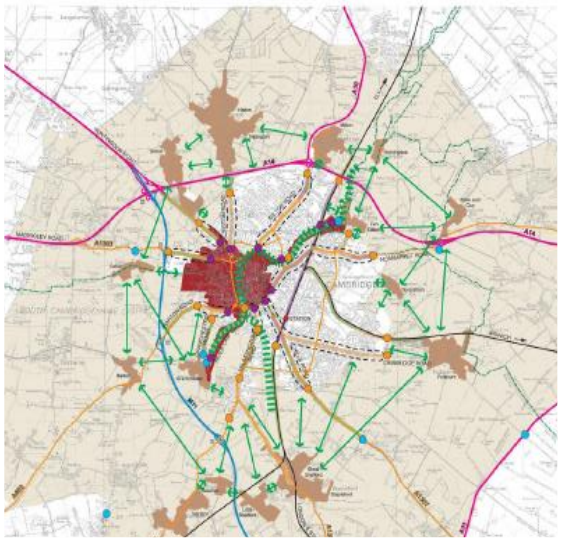


Fig. 5. Cambridge green belt study [5]

1 *2* *3* *4*

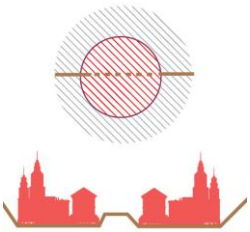
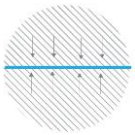
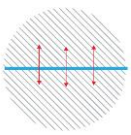
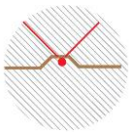
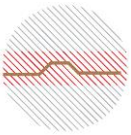
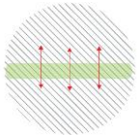
Fig. 6. Highlighting urban programs in the central part of Köln city: 1 – green belt (parks, squares, other greenery) surrounding the central part of the city; 2 – the system of public spaces surrounding the historical nucleus; 3 – integration of the river Rhine through public spaces and new functions; 4 – main spatial channel in the central part of the city as a connection between the East and the West [6]

The entry length was measured from the city gateways to the gateways of the most characteristic Cambridge zone. On that basis, three types of city gateways were identified: the first Cambridge view (sight-point when entering the city), the city gateway (a node where a built-up territory of the city begins) and the gateway to the characteristic Cambridge (a node where a visitor feels that he has already arrived in the city). These were informative landmarks highlighting individual parts of the city.

Analysis of the master plan solutions of Köln city in Germany [6] shows a clear separation of the peripheral building-up characteristic of Köln from the central area of the city by creating a green belt (Fig. 6). The boundary of the central area is examined as an integral spatial structure. Transverse connections are developed, connecting both city zones. The main nodes of the spatial structure are distinguished. A higher building-up is formed, tracking the parameters of the space along the structure boundaries. Higher hills are created upon the establishment of the zones of visual shadows from the historical part of the city. The park structure is divided into separate parts – parks and green zones with different features and characteristics. Building-up is formed by separating a park from the highway. New functions and human activities are created in the park. The inner ring surrounding the city nucleus is the legacy of the 19th century, when the inner ring of defensive reinforcements was broken in order to be able to open the city for the development of the so-called new city. It was then that the creation of the spatial structure of public spaces consisting of boulevards, streets and squares started, which today is difficult to recognise, therefore it is expected to return to the original concept by the solutions of the master plan. Understanding the separating character of the river Rhine, a program for the development of public spaces on approaches to the river is planned. The aim is to integrate both the sides of the river into the active life of the city. The eastern-western axis crosses the whole central part of the city and is the backbone of the territory, and it is, therefore, envisaged to reshape the image of existing squares, to resolve the functional issues of the light railway, etc.

TABLE 1

Peculiarities of a natural boundary [created by G. Žukaitė]

Element	River		Relief		Greenery	
Shape in a plan, section (geometry of the shape)						
	continuous line		fragmented (dotted) line		territorial area (guessed boundary)	
Meaning	One of the most important natural axes in the city; until the beginning of the 20th century, a factor that generated the economy of the city		Often determining the formation and expansion of the urban fabric		Integral part of the formation of public and recreational spaces in the city	
Relationship with the city (positive/ negative) (model in the plan)	"+"	"–"	"+"	"–"	"+"	"–"
	Water resources, navigation, fishing, recreation; river as an object of attraction	The image of the boundary is enhanced by wild banks of the river.	Panoramas opening due to the expressive relief, a big number of sight points	Zones unfavourable for building-up, difficulties in forming building-up	Recreational spaces, parks, squares	Territories of abandoned greenery are not only a visual but also a physical boundary.
						
Boundary solution methods / boundary potential	Development of links and connections; integration of the river into the common urban fabric of the city: improvement of river banks, adaptation for recreation		Integration of relief into the urban fabric of the city (by terracing, formation, etc.)		Management of abandoned greenery; formation of parks, squares; fragmentation of greenery in the urban fabric of the city	

Practical examples show different principles of highlighting or eliminating an urban boundary: the central boundary of the city is perceived as a park system, the boundary of the nucleus – as a system of public representative spaces, different urban areas have nodes corresponding to the rank of the area and marking the boundary, which also perform the territories bridging function. For solution of the natural boundary, the principles of merging are employed (public spaces, bridges, the introduction of new functions in the existing built-up structure). When observing the character of the boundary continuity, it is considered to be continuous, dotted, fragmented or only guessed in view of the surrounding situation. However, regardless of its category, character or geometry, the provided study of theoretical and practical works illustrates that the physical boundary usually operates both as a tool and as a catalyst in process of further improvement of the urban fabric.

Urban boundaries in a structure of a city

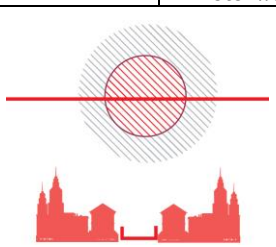
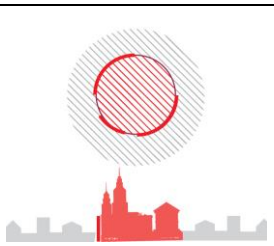
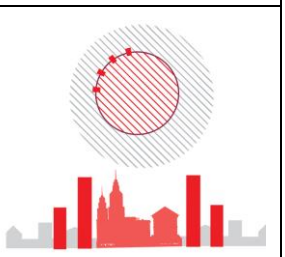
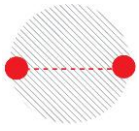
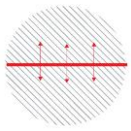
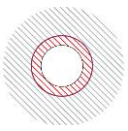
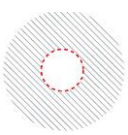
Boundaries in relation to a city

Based on the analyzed sources, urban boundaries are primarily identified in relation to the city itself [7]. Today, cities are generally perceived as complex combinations of individual parts of a city. Most European cities have developed from the historic nucleus as radial structures (radial plan). According to peculiarities of historical development and building-up intensity, the following structural parts of a city are distinguished: the historical

TABLE 2

Peculiarities of an anthropogenic boundary [created by G. Žukaitė]

[1]E.g. high-rise buildings in accesses to the city centre

Element	**Spatial channels (transport infrastructure)**		**Building-up**			
	Railway	**highway/ motorway**	**Defensive wall**		**Complexes**	
Shape in a plan, section, geometry of a shape						
	continuous line		fragmented (dotted) line		territorial area (guessed boundary)	
Meaning	One of the main transport lines between cities and countries		Important part of the city, a significant historical legacy		A part of the identity of the city or its fragment	
Relation-ship with the city (positive/ negative) (model in the plan)	"+"	"–"	"+"	"–"	"+"	"–"
	Mobility lines are developed, connecting important elements of the city.	Clear boundary, dividing the territories, breaking existing links	The limits of the historical nucleus of the city are highlighted.	In some cases, visual and other discomfort is caused by abandoned fragments of a structure.	The boundary is perceived visually; it is weak, does not break existing ties; in individual cases it highlights different parts of the city[1].	Poor quality, abandoned building-up of industrial territories can serve not only as a visual limit but also as a physical barrier.
						
Boundary solution methods / boundary potential	Development of links, connections (bridges, structures above tracks, underground passes)		Defensive walls are a historic heritage that must be preserved.		Pulling down of buildings of low architectural value and reshaping of the territory; integration into the common urban structure, structuring of the boundary	

nucleus of a city, the central area and the urban boundary separating extensive suburbs from more intensive city areas. The main radii of radial cities (usually, the main city streets) – accesses to the city, cross these boundaries, and points of intersection, i.e. nodes, are perceived as gateways to a more intensive building-up zone. On this basis, a distinction can be made of physical boundaries in relation to the city:

- *The boundary of the historical nucleus of the city*, the formation of which used to be determined by the historical development of the city, the geographical situation of the city. For defence purposes, the territory of the city used to be surrounded by defensive walls and the suburbs were built at a distance. The suburbs continued to be formed without any more or less clear urban structure until the 19th century (Vilnius, Riga, Tallinn, Krakow, Bremen, Vienna, Wroclaw, Leipzig, etc.). Today, a defensive wall can be detected in different forms according to its degree of survival: continuous, fragmented or simply guessed. Elements forming it may include building-up, system of public spaces or transport infrastructure spatial channels.
- *The boundary of the central area of the city*, usually surrounded by the corridor of highways

and often accompanied by the problem of their humanization [8] [9], as nodes significant for the city are created at the main accesses to the central area, with a prominent architectural expression on the background of the city. This territory is characterized by intensive building-up, high quality of public spaces, etc.

- *The legal boundary of the city* usually marks the transition between different regimes, i.e. from the city to the countryside. It is a boundary between the old/new industrial and agrarian culture. This boundary is often of irregular shape and is not clearly distinguished, especially if it is not formed by significant natural environment (sea, mountains, etc.).

Classification of boundaries

The typical character of a boundary is the image of a linear object dividing/separating two areas. Boundaries can be crossed easily or with difficulty, which determines the existence of weak or strong boundaries. The strongest boundaries are those which are not only perceived visually but also intersect movement. The characteristics of the boundaries between different territories describe the character of the city or its part, determine its perception and orientation. The clearest boundaries relate to distinct, continuous natural or anthropogenic elements: river, slopes, railway or highway lines. A boundary can be of natural (related to elements of nature) or forming nature and is, therefore, classified as natural or anthropogenic.

Natural boundaries are most often elements of a unique natural environment, in which the city developed (river confluence, sea coast) for military-defence or transit purposes. Although some of them have remained, their significance has now changed, the possibilities of converting them into public recreational urban spaces are addressed. In most cases, natural boundaries relate to more significant water bodies, such as rivers, ports or wetlands. In this case, boundaries are such elements as coastline or marinas, whose means of expression may also vary considerably, depending on the way water is used and the degree of urbanization of accesses to it (e.g. even the coastline themselves are divided into several types: hard, soft, perforated edge, built-up, etc. [10]). In cities with a more prominent topography, slopes and valuable greenery become natural limits (Table 1). At the same time, the boundary of greenery is often created instead of a former defensive wall. This trend is typical of European cities, where the historic part of the city is highlighted by surrounding it with a continuous system of public spaces and parks or separate park fragments.

Anthropogenic boundaries in cities are man-made boundaries: some of them are formed by building-up (defensive wall, high-rise building complexes), others often are transport infrastructure elements – highway and railway routes [8]. In many cases, the latter even have strategic implications not only for the city, but also for districts (both physically and visually), creating negative barriers by slowing down the path of movement from one location to another. As a result of intensive highway, railway traffic, people must go under or above them in order to cross the barrier, additional solutions are created for them, restricting movement patterns (Table 2). Meanwhile, the boundaries formed by building-up usually separate areas of different profile, which differ both by their character and social, economic and other aspects.

Practical illustration of urban boundaries – the city of Vilnius and its district Naujoji Vilnia

Boundaries on the city scale

As it is often a case with a large city, Vilnius has enough physical boundaries in its urban fabric. Their location in the city is not accidental and often leads to problems of connection of individual territories. The river and the railway are among the most obvious in Lithuanian cities. It is namely the location of these boundaries in Vilnius city that divides the districts or even causes a lack of integrity in their inner structure. Physical boundaries were identified for the whole city, later – for selected districts. This helped to understand the different scale of boundaries and their impact on the structure of the city.

In order to identify the main areas of Vilnius city that are most affected by the boundary problem, to determine the effects of the boundaries and the need for their elimination or consolidation, an urban analysis of Vilnius city has been carried out covering administrative structures (legal boundaries of districts), analysis of Vilnius development models (applied to Vilnius city in 1995 and 2015), topographical situation, transport infrastructure, urban transport flows and their influence on boundary problems, a plan of physical boundaries of Vilnius city has been prepared.

In studying the administrative structure, the years of formation of individual administrative sub-districts (elderships) and their joining the city have been determined. The legal boundaries in Vilnius city are not physically felt or visually visible. However, when examining the urban development strategies prepared after the restoration of Lithuania's independence (1990), attention was drawn to the emphasis on the application of the polycentric urban model, which would be successful due to the very uneven distribution of the urban centre environment. The lack of that environment is felt in the residential areas on the right bank of the river Neris (Fabijoniškės, Pašilaičiai, Verkiai,

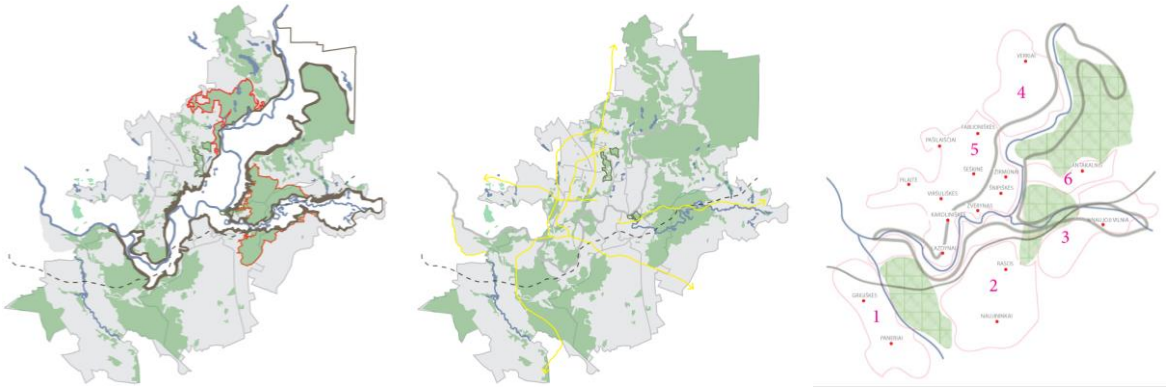


Fig. 7. Schemes of the city of Vilnius: (1) natural boundaries; (2) anthropogenic boundaries; (3) parts of Vilnius city affected by the boundaries [created by G. Žukaitė]

Karoliniškės, Šeškinė, Pilaitė) and in Naujoji Vilnia. These areas house about 45% of the total population of Vilnius, and the districts themselves are very different from the Old Town in terms of architecture, planning and functional composition. The residents of the remote districts are doomed to daily commuting to the historical part of the city for cultural, recreational, household or work purposes. Over 50% of all jobs are focused in the city centre. This apparent functional grouping and the separation of the rest of the city from the centre identifies a clear task of achieving a balanced distribution of services, jobs and housing in the city. This would result in a more even distribution of functions and "removal of heavy weight" from the central area of the city [11]. In order to optimize the allocation of functions, the convergence of districts should be avoided and, in line with the principle of balance of functions, a polycentric urban development model for the city of Vilnius was proposed, which would help some districts, somewhat distanced from the central area (including Naujoji Vilnia), in their smooth integration into the full-fledged system of city districts and becoming its constructive participants. It would be all the more so if strategically some functions generating the economy of the city were moved from the central area of the city to the city parts mostly separated by natural and anthropogenic boundaries.

The analysis of infrastructure and city transport flows has revealed the lack of transport lines enabling elimination of exclusion of districts. In the study of significant locations of natural boundaries, three main elements were identified in the city of Vilnius: the river Neris and the river Vilnelė and their valleys, as well as large plantation arrays belonging to regional parks (Fig. 7). Almost the most striking anthropogenic boundary in Vilnius city is the railway line. The busiest Vilnius streets (Ukmergės St., Geležinio Vilko St., Laisvės Ave. and the western bypass) can also be classified in the category of anthropogenic boundaries. Based on the findings of the urban analysis, a plan of physical boundaries of the city has been drawn up, clearly highlighting the division of the city by the boundaries.

On this basis, six separate parts of the city and three Vilnius city zones mostly affected by urban boundaries are pointed out (Fig. 8):

- *The suburbs* with an industrial area in the East, where two boundaries are found: the Neris tributary and the railway. The degree of urbanization in the area is low, the vast majority of the railway is in the woodland zone, therefore the railway area does not have a significant impact or does not cause substantial changes in the area, and the river tributary does not influence the formation of the district, so the existing number of connections across the boundaries is fully in line with the use of the area, besides, with regard to the local topography, it is a rather flat area.
- *The city centre* (central area) is the most urbanized zone from all the three indicated areas. It is dominated most clearly by the only anthropogenic boundary, i.e. the railway, with accesses of industrial functions in the area. In relationship with the environment, the historically formed links that have been cut and city districts that have been separated from each other are to be pointed out. Six connections are found in this zone, but they are formal, operating only as infrastructure elements, but not as fully-fledged connections between districts, all the more so that accesses to them involve enclosed territories forming a section that is not fully used. Although both the sides of the railway are characterised by vivid relief, however it is not felt in the overall urban structure due to the degree of urbanization in this zone.
- *A separate district* of Naujoji Vilnia, which formerly was an autonomous town. Even four boundaries are identified in this zone. They are all of a different nature: two natural boundaries

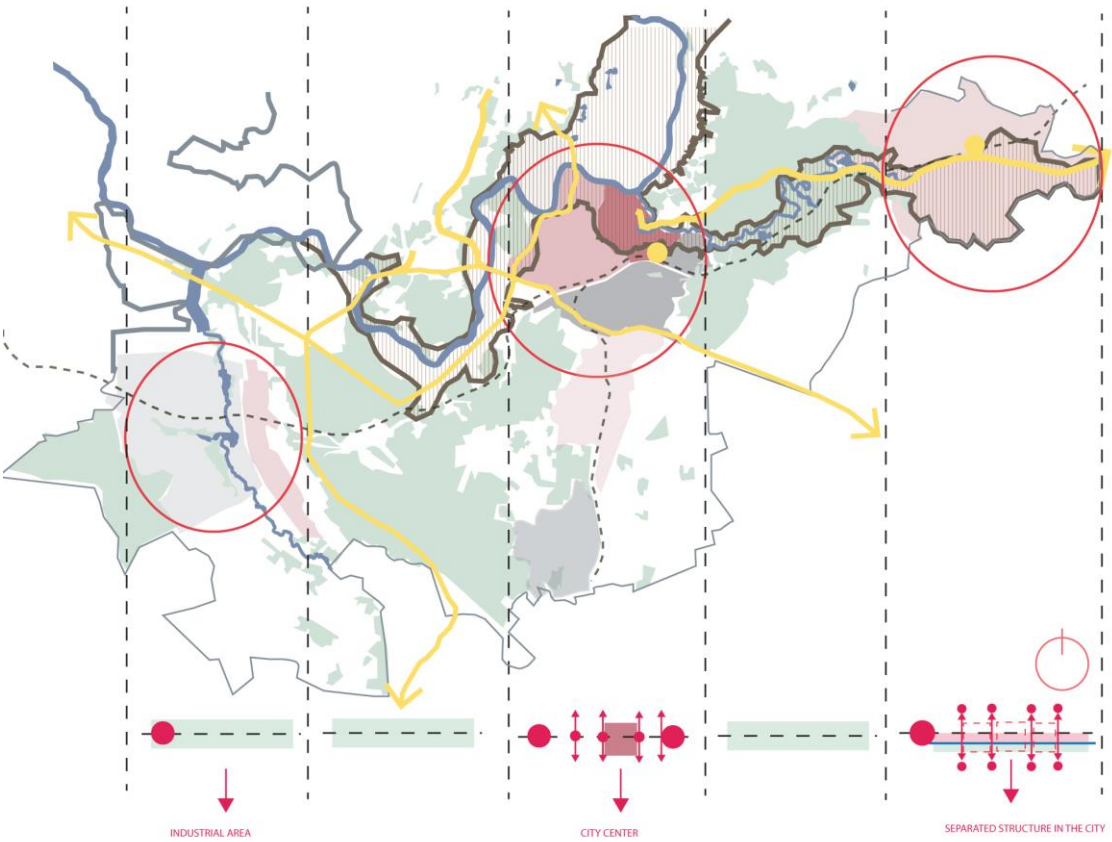


Fig. 8. Territories mostly affected by boundaries [created by G. Žukaitė]

(a river and massive greenery) and two anthropogenic boundaries (the railway and an industrial area established nearby in the Soviet times). Being close to each other in the urban structure, they form a complex multi-stage boundary, which becomes an obstacle in the urban structure of the district, while the existing connections across the railway section do not resolve the boundaries integration issue. The exceptional situation is also dictated by the local topography, which is quite prominent.

In view of the complexity of the identified urban boundaries, Naujoji Vilnia district was selected for the study, which would allow demonstration of the miscellaneous phenomenon of physical boundaries in the urban structure on a district scale. The natural situation in the district itself created conditions for emergence of this phenomenon, which in itself has led to the adjacency of the natural boundaries, and the effects of these boundaries on the district have been further strengthened by human activity.

Boundaries on the city disctrict scale

Naujoji Vilnia today has no clear role either in the overall structure of Vilnius city or in the internal urban composition: it is a district of weak character with few identified and respectable elements capable of representation not only in the context of the district but also in the context of Vilnius as a whole. Although the district can be very independent, as at its beginning it was an autonomous town that joined Vilnius only in 1957, this district counts already the 7th decade (63 years) within the city in Vilnius but, in spite of that, it is still isolated from the rest of the city area both physically and functionally. The district itself is grateful for its natural situation and has a number of significant historical facts, but the complex combination of different types of boundaries that formed in it is probably the most prominent cause of the fragmentation of the urban structure.

Therefore, in order to explain the nature of the urban boundaries and its advantages and disadvantages in the district, a much more detailed urban analysis was carried out on the scale of Naujoji Vilnia district compared to that of the whole city: by revealing the formation of the boundaries through the urban development of the district, the laws and principles of the natural frame and the structure of public spaces and the very character of building-up.

The contemporary Naujoji Vilnia district is a relatively new urban formation, which emerged in the middle of the 19th century, at the intersection of railway lines connecting St. Petersburg and Warsaw, also Liepaja and Romny [12]. For some time, Naujoji Vilnia acted as a separate town independent of Vilnius. The first elements of Naujoji Vilnia

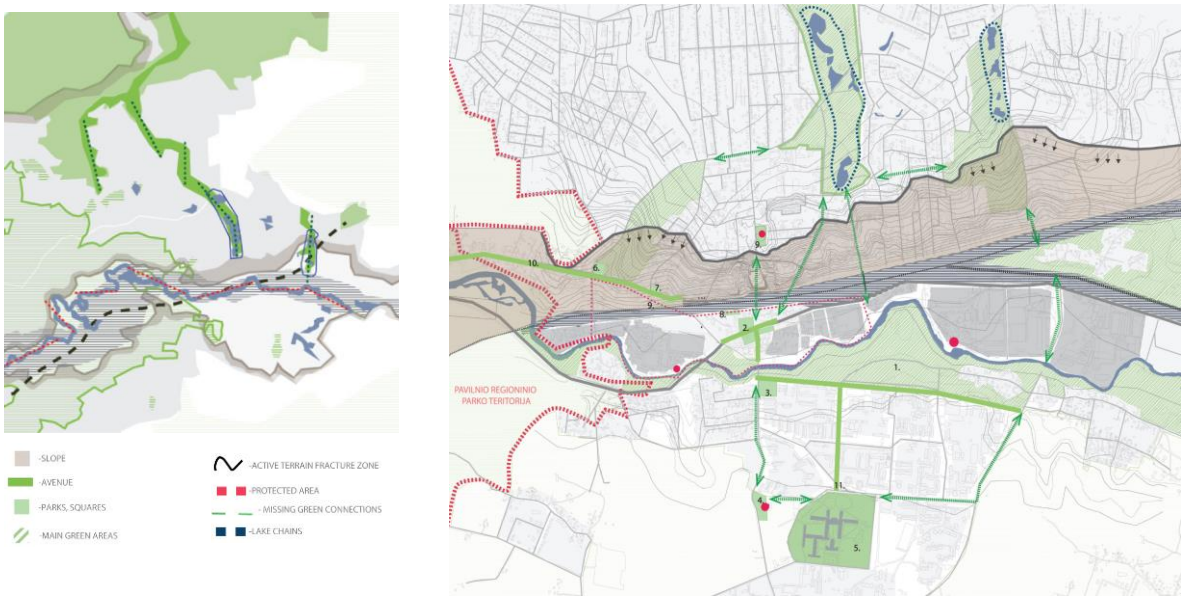


Fig. 9. Naujoji Vilnia natural frame and system of green spaces and possible connections [created by G. Žukaitė]

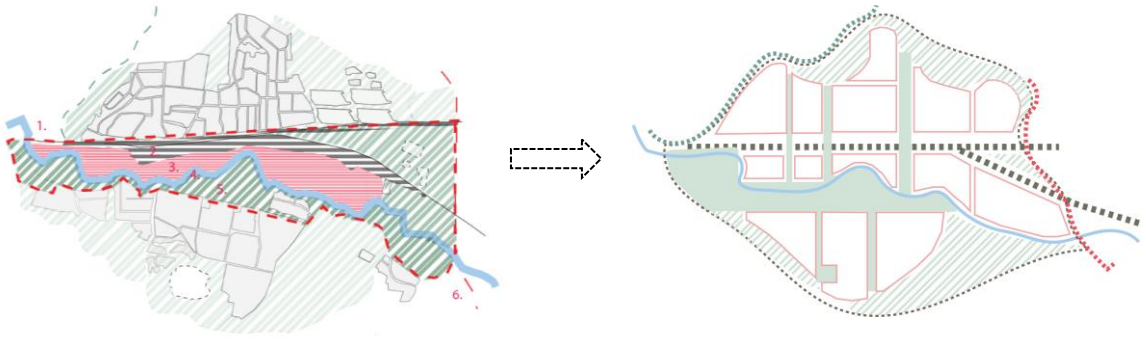


Fig. 10. Model of the existing and forecasted situation in Naujoji Vilnia district [created by G. Žukaitė]

building-up came in the middle of the 19th century, and the main driver of the settlement development became the railway lines and later the railway station. Given the topographic parameters of Vilnius surroundings, the valley of the river Vilnelė was the only way to build a railway line from Vilnius to the East and the place at Naujoji Vilnia was the place to create its branch to the South-East. It can therefore be assumed that it was the topographical situation of the area that determined the emergence of the Naujoji Vilnia railway station, from which the history of the district starts. The railway line was not only a catalyst for the district creation, but it also played an important role in the formation of the urban fabric in the district. It was on the northern and southern sides of this line that the first building-up of the area appeared. The river Vilnelė also played an important role here as the main natural axis in the area in the East-West direction. In this case, it was involved in the development of the urban structure as a natural barrier, limiting the expansion of the district building-up to the South. Naujoji Vilnia started to expand to the southern side of the river Vilnelė only after a mental hospital complex was built here at the beginning of the 20th century, but the urbanization of the southern valley of the river Vilnelė of a larger scale has been only taking place since the middle of the 20th century.

It was initially a railway workers' settlement consisting of small wooden buildings, the building-up character of which was that homesteads, located along the railway line. After the railway station was constructed, the area transport conditions improved and Naujoji Vilnia became economically attractive. With a possibility of exports, industrial objects started to emerge here. It should be noted that industrial objects appeared and developed on the southern side of the railway line on the right bank of the river Vilnelė. This zone acquired its industrial purpose, which it maintained until the end of the 20th century. The first multi-apartment residential houses of the perimeter building-up character appeared at the main transport route to Vilnius (Polocko St., currently A. Kojelavičiaus St.). When a church was built on the right slope of the Vilnia river valley (at about 1911), the settlement building-up expanded to the northern part of the territory, the formation of the town centre started,

also isolated fragments of satellite homestead-type building-up appeared. For some time, Naujoji Vilnia acted as a separate town independent of Vilnius, it became a part of the city of Vilnius only in 1957.

A part of the territory between the railway line and the river Vilnelė became a zone of large-scale industrialization. The free planning industrial building-up that prevailed here before World War II became even more widespread, a different nature of volumetric-spatial organization became more apparent: industrial complexes built before the war were low, were extensively distributed as small scale buildings in the area, whereas the objects that appeared during the post-war industrialisation were higher and of a much larger scale.

After analysing the natural structure of Naujoji Vilnia, two prominent natural wedges into the urban fabric of the district were identified (Fig. 9). Other important natural elements include a clear slope, the river Vilnelė with its valley, a broad green zone along the river. All of them act as a strong boundary, which lacks integrity and interconnections. The river with its banks also acts as a boundary dividing the district: there are no formed accesses to the river, the banks are abandoned, with little integration into the urban fabric of the district. The river acts not as the main natural axis of the district, but as a strong barrier.

As regards the system of public spaces in the district, these do not constitute a smooth network, at best, they stop at the complicated section of boundaries. The expressive relief of the territory gives rise to a number of sight points, but the visual identity of the district is negatively affected by free planning territories with chaotic building-up of homestead type and a broad zone of visual pollution – abandoned industrial territories, standing out from the general district building-up by their scale.

The railway section and the industrial area within the district are perceived as a whole indivisible zone. The first element divides Naujoji Vilnia district longitudinally into two parts. The infrastructure line is very wide and not used properly, while the second part is the industrial area almost merged with the railway, abandoned and aggressive in the general context of the district by the scale of its building-up (Table 3).

Thus, the area is affected by both natural and anthropogenic boundaries. The situation is also aggravated by the fact that all of them form kind of a single section, with a few formal links, but in general the section is regarded as a physical barrier and an obstacle for the territorial development of the district. In principle, it can be identified as a multi-stage physical boundary, the effect of which is negative rather than positive. Based on the study of literature sources and projects (Lapėnienė, 2005; Salingaros, 2005; Birthler, 2018), strategic options for this complex boundary are therefore presented, capable of complementing the entire urban fabric of Naujoji Vilnia, as well as contributing to the creation of the identity of the district and a new image of the district (Fig. 10).

The boundary of the district in the East coincides with the city boundary, whereas in the West it borders with the Pavilniai regional park. The boundaries *are to be reinforced by emphasising them* by use of contrast elements/materials:

a) the city sign or a plastic sculptural composition of the city symbol is suggested at the city boundary, which is usual in such cases. The boundary may also be visualised by infrastructure elements (entry roundabout, slow-down lanes, etc.);
b) the boundary at the regional park is the intersection with the district area and is therefore considered as an access to the district, where it is proposed to create the character of a district gateway by urban means – extending the building-up with low residential houses to the point where the regional park starts.

The railway effects are to be mitigated by the use of the juncture geometry:

a) eliminating some of the tracks that are no longer used and narrowing of the railway section itself;
b) creating vertical links joining different parts of the city in certain zones;
c) developing a horizontal system of interconnections in the accesses to the railway, covering a part of the railway and creating public spaces above it.

The river is to be integrated by means of joining of structures through elements of the boundary:

a) forming spatial channels towards the river from both the southern and the northern parts of the district, merging into the system of public spaces being developed on both the sides of the river;
b) upgrading the building-up on the banks.

The industrial area is to be converted using its own territory for integration as elements of the boundary:

a) forming the building-up of the scale specific to the district, development of its polyfunctional nature;
b) priority is to be given to complexes generating the economy of the district.

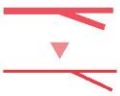
The green zone is to be developed as a structural boundary able of connecting as puzzle pieces or using its own territory for integration as elements of the boundary:

a) continuing green connections towards the existing district squares and parks, integrating this zone in this way;
b) as the area is big, suggesting a recreational function in some of the area, which would connectn the southern and northern parts of the district.

Urban boundaries in a city are one of the structural components of the city. Depending on the situation of the city, the identified boundaries most often coincide with structural parts of the cities: the historical nucleus, boundaries of the central area and the legal boundary of the city. With very different

TABLE 3

Peculiarities of a natural boundary [created by G. Žukaitė]

No.	Element (type of boundary)	Shape (geometric expression and plan)	Relationship with the district	Boundary solution methods
1	Railway (anthropo-genic boundary)	Continuous boundary 	"+" mobility lines are developed, connecting important elements of the city "–" a prominent boundary, dividing the territories, breaking existing pedestrian connections	The boundary is to be partly eliminated by narrowing the rail tracks, developing communications and connections (bridges, structures above the section, underground passes) 
2	Abandoned industrial zone (anthropo-genic boundary)	Territorial area 	"+" active industrial function – it is generating the district economy and raising its economic level "–" poor quality, abandoned building-up of industrial territories serves both as a visual and physical barrier	Territories of low architectural value, of contrasting scale are to be integrated into the urban fabric, converting them into a structure useful for the district, with relevant functions. 
3	The river Vilnelė (natural boundary)	Continuous line 	"+" water resources, fishing, recreation, river as an object of attraction "–" the image of a boundary is enhanced by wild banks of the river	The river is to be integrated into the common urban fabric of the city by means of public spaces and new functions in the accesses to it (improvement of the river banks, adaptation for recreation, formation of new connections). 
4	The green zone (natural boundary)	Territorial area 	"+" recreational spaces, parks "–" the territories of abandoned greenery are not only a visual but also a physical barrier	Green connections are to be developed with major parks and green areas of the district – the territory is to be exploited for recreational purposes, structured, abandoned greenery are to be managed and new ones are to be formed. 
5	The regional park and city boundary (legal boundary)	Continuous line (guessed) 	Legally regulated	The strengthening of the legal boundary is possible by framing it, so a building-up line of certain intensity inside the city is to be newly developed, whereas on the outside, the boundary may be marked. 

degrees of survival of the nucleus boundary, the boundaries of the historical nucleus can have different geometry: continuous, dotted, fragmented or only guessed. In the meantime, the boundaries of the central area are distinguished by a belt of parks, fragments of public spaces, nodes of high-rise buildings, infrastructure elements. The city boundary is marked by vertical points, their groups or large complexes. When analysing the means of expressing urban boundaries, they can be categorized by nature (natural and anthropogenic), by natural and man-made character, by scale, by relationship to the environment, etc.

The study of reference sources analysing the urban boundary has revealed that the most common natural boundaries are analysed as a single structure, adapted for recreation, the nodes of the boundaries are distinguished according to the hierarchy of transverse connections, the number of connections is increased. A similar situation exists with anthropogenic boundaries, which are also examined as a single structure in creation of transverse connections and distinguishing the hierarchy of nodes.

If the perception of the urban boundary is simplified down to the elementary geometric elements, three principles of connection are possible: (1) two morphostructures are joined by contrast materials or geometric properties; (2) a structure is wedged into / interconnects with another one or overlaps; and (3) two structures are joined together through a third element.

An applied experiment has been carried out to identify urban boundaries, which involves overall observation of the lack of attention given to urban boundaries, the problems they cause, leading to greater exclusion and segregation. In addition, different parts of the urban fabric do not complement each other, are not in contact, remain unconnected, which is reflected not only in the urban structure but also in social and economic models. Therefore, after a comprehensive urban analysis at the scale of the selected city of Vilnius, the elements of the city that are significant in separating urban territories are identified. The same elements forming urban boundaries are found after the analysis on the city district scale – in Naujoji Vilnia. In order to reduce the district's exclusion from the rest of the city, the strategy for a polycentric city model is proposed, improving both its economic situation and functionally integrating the district into the common system of districts – moving some of the functions from the city centre in order to make the district more attractive to other citizens of the city. The internal urban structure of the district identifies a specific phenomenon of the boundary – a complex combination of boundaries, consisting of several different boundary components: the railway, the river, the industrial territory and the green zone. The analysis carried out has highlighted the importance of connections between different structures of the district. Therefore, observing the negative effects of the existing boundaries, methods of elimination/integration of the boundaries are proposed, based on the performed study of theoretical references and practical work. The proposed new vision for the development of the district is linked to the creation of hierarchical urban public spaces, which would structurally combine isolated parts of the district and the main objects forming the district identity. A number of strategies are suggested for the development of the urban fabric: natural elements are to be used to make the structure not so big, the building-up structure is to be extended towards the natural element, elements of the formed building-up are to replicate the natural form (contour lines, water line) and continue the natural elements.

According to the references studied and the experiment carried out, urban boundaries should be highlighted in the urban structure, adding uniqueness to the character of the city and reinforcing its identity. Depending on the situation and the character of a physical boundary, it can be both a tool and a catalyst in the urban structure of the city.

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Kopsavilkums. Rakstā ir sniegts teorētiski fundamentāls fizisko robežu pētījums par Viļņas pilsētu. Pētījuma mērķis: noteikt pilsētas robežās daudzdimensionālo raksturu, pozitīvās, negatīvās ietekmes uz esošo pilsētvidi. Rakstā tiek pētīta gan pilsētu robežu teorētiskā platforma, praktiskas pieejas un projekti, telpiskās struktūras likumi, kas izriet no fizisko robežu uztveres, kā arī principiālie risinājumi, lai novērstu robežu negatīvās sekas un veicinātu pozitīvu attīstību. Autori pēta dažāda mēroga teritorijas, vietējā kontekstā un principus, kas piemēroti analizētajām teritorijām.

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Cultural heritage sites in Vilnius: a critique of selected interventions in landscape architecture

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Abstract. International researchers intensively explore the tradition of criticism in landscape architecture theories and practices from different angles: socio-cultural inquiry, historic prospective and retrospective, heritage perception and cognition, modern public engagement. Over the past two years, Vilnius City has witnessed a breakthrough in the public debate on urban open space, and several landscape architecture projects related to the revitalization of the cultural landscape have provoked the active public debate. Three selected cases have multi-layered evolution in which previous solutions have been deliberately or naturally denied by subsequent ones. The aim of the paper is to analyse and summarise the state of collective memory and tendencies of stakeholder's opinions that influence the creative process in landscape architecture projects. The paper analyses the opinions of three stakeholder's groups about the projects going to be realised: the public, the planning and design professionals and the client, with own regard to the project. The feedback material from the published articles, critical comments, record of public discussion and some other public and institutional media resources are analysed. The ecological, aesthetic and social-economic aspects of the feedback material are represented through the preselected criteria and the detailed indicators. The main conclusion of the study is the notion that early and a wide-ranging discussion with the public during the process of landscape revitalisation can harvest the best public acceptance of landscape change. In the analysed case, it showed the absolute stakeholder's preference for the multi-layered representation and interpretation of the authentic landscape material and its mental memories that promote the continuum of landscape development as a contemporary public interaction arena. The shorter was the lifespan of the place, the more outrageous debates took place with little consent in all aspects. In case of the longer timespan of the place, there were more consensuses between the stakeholders on the analysed aspects.

Keywords: landscape architecture, cultural landscape, collective memory, revitalisation, society

Introduction

There is an active debate ongoing between the researchers and the practitioners of several fields of landscape, urbanism and architecture on what and how the real values of the place could and should be safeguarded and brought to life in the process of landscape modification. Meeting the public understanding and satisfying the needs of modern society is the other must for the cultural landscape projects of this kind. Local authorities expect landscape architects to develop the proposals that would correspond to public perception of local identity of a place in the best possible way. To get a deeper understanding of these trends in research and in practice we have gone through the state-of-the-art analysis of several projects of cultural landscapes in the heart of Vilnius City.

Background

Memorial landscapes are proved to have multiple layers that should be reflected in the recent look of those places [11]. Researchers assess the differences in approaches to "landscape as a fact" in order to better reflect on landscape memory and its symbolic values [4]. The deeper review of essence – temporality paradigm discloses that practitioners and the stakeholders frequently debate about the ways to build on the permanent landscape qualities and take them to the present day use [12]. Memories can be provoked even by the alternative – virtual "monuments" by empowering diverse sensorial experience e.g. by audio guiding tools [10]. Cognitive perception of historical urban skyline is an important process of landscape perception, and it may act as a mental sketch in the urban space experiences and be expressed by skyline drawing and multi-sensorial perception [2]. Analysis of the multiple commemorative roles that landscape can play shows that collective memory even of the painful events of the close past depends on the local culture and identity that needs to be addressed in landscape interventions in a creative way [6]. Providing the visitors of created landscapes with a complete cultural experience may be the critical factor in becoming a loved and visited site instead of political and ideological loads that authorities frequently drop on the memorial sites [8]. Religious landscape sites often find themselves in between of the memory and the value, and good governance models along with multidisciplinary analysis may be the way to bring their cultural legacy forward even in a situation when their original type of use is abandoned [3].

The selected criteria and their indicators							
Ecologic		Social		Aesthetic		Memorial	
Total protection	E1	Openness	S1	Neutrality	A1	Current	M1
Ecosystem	E2	Community	S2	Interpretation	A2	Multilayer	M2
Selective protection	E3	Recreation use	S3	Complexity	A3	Fragmented	M3
New plantation	E4	Representation	S4	Decoration	A4	Historic	M4

Researchers also apply the method of Design through Research (DtR) for facilitating participatory design, and they identify the professionals, the institutions and the community as three main operating sides shaping the built environment [1]. The reviewed resources illustrate the variety of approaches and research methods that when applied may bring one closer to understanding the essential processes within value making. The methodology of research and design and the criticism trend of landscape urbanism brings the new type of quality criteria and indicators mainly focusing on appreciation of natural values in the development of urban landscapes. There are experimental studies that use this methodology as a set of 14 criteria in four themes to assess the quality of urban landscape development in Vilnius City, and the results show absolute benefit of applying landscape urbanism methods and tools as compared to conventional approaches of the XX c. [14]. The authors of reviewed resources when analysing the participation theme usually involve three main groups of stakeholders into questionnaires and other participatory activities: landscape architects, municipality staff and community members [7]. Researchers raise the question whether we could better understand novel ecologies of existing sites as relational landscape if we take a closer look on their histories, memories and individual timelines [9].

The method and the material

From the perspective of landscape architecture science, it is important to understand what causes differences of opinions about cultural memory preservation. This study responds to a problem raised by the IFLA-Europe discussion on Landscape as a Collective Memory, as to search for answers on reflection of memories in landscape projects and objects. How can we carry our inherited legacies to the future? How can we carry the traces of the past through the present and to the future? The challenges of maintaining historic gardens, especially those that have become public-use gardens, are today more and more reflected in a social and an environmental domain. The aim of the research is to summarize the state of collective memory and tendencies that influence the creative process and means of landscape architecture based on opinions stated by the public representatives in the public media: press, internet, and discussion meetings. The qualitative research analyses the press and critical comments, opinions and proposals from the public on three landscape architecture projects and the recorded minutes of public discussions.

The research analyses and compares the opinions and positions of three groups of stakeholders regarding a project – the client (municipality and agency), the landscape architecture professionals who elaborated the project proposals, and the local public. That material is stored in the archive of Vilnius Municipality. For comparative analysis, documentation of design assignments is used to express the intended expectations of the client. Some members of this research study were directly involved in managing the process of creating the selected landscape projects under investigation. The consolidated opinion of landscape professionals was not available, as they have just expressed separate contradictive opinions. The analysis is based on four key dimensions: ecological, socio-functional, aesthetic and collective memory, – revealing through a variety of views of the criteria and several preselected indicators for each dimension and their weight distribution.

In the study, criteria were grouped to reveal differences of opinions expressed by different groups of stakeholders. As it was difficult to compare and structure different opinions due to their diversity and authentic nature of expression, we have converted the individual opinions expressed in public debates on the analysed projects into generalized criteria, which were grouped into four thematic categories: Ecologic, Social, Aesthetic, and Memorial [5]. We have distinguished the four most characteristic indicators in each set of criteria by giving them the code marks E, S, A, and M (Table 1).

Three case studies

We have selected three case studies in Vilnius City that meet the criteria of recently designed areas with multiple cultural heritage layers in urban landscape provoking wide public discussion. The project of the Reformation Garden is 2,78 ha size site in the centre of Vilnius that is currently under implementation and regards the area that former Vilnius city authorities dedicated to the Cemetery of Protestant Reformers in 1639. At the beginning of the 20th century with the development of industry and growth of the city, the South-Eastern part of the garden area was leased for the construction of trade pavilions. Until the Second World War, the area changed little. In the post-war period, between 1950 and 1958, the area was left undermaintained and

Figure 1. a) The view of the Reformation Garden until 2018. Žiūra, S. photo. Source: https://15min.lt b) Visualization of the monument to the Reformation within the conserved Reformation Garden area. Authors Matulaitė, D. Balkevičius, J. Project visualization.

TABLE 2

The criteria distinguished through the analysis of public presentation of the project for the Reformation Garden conservation

Criteria groups	Opinions of different stakeholder groups		
	The public	The project professionals	The client (municipality)
Ecological	Save all existing trees Ecosystem protection Protecting biodiversity Avoid demolitions	Selective protection of trees New plants Terrain restoration	Trees inventory Terrain recovery Increasing green space
Socio-functional	Maintain existing transit No fencing Universal spaces	Internal path system Functional zoning Children's play area	Memorial function associated with short-term recreation
Aesthetic	Adaptation of existing concrete structures Refusal of decoration Stylistic unity	Relief recovery Removing concrete structures Abundance of elements	Relief restoration. Actualisation of Reformation cultural heritage by the artistic tools
Collective memory	The multi-layered story The educational role of living history	Priority for period of the Reformation cemetery Activities for public recreation.	Multidimensional reflection and honouring of the Reformation cultural heritage

consequently was abandoned by citizens, and soviet authorities have gradually demolished the remaining buildings. In 1983, this area was transformed into the square dedicated to honour Soviet soldiers, and the gigantic scenic monument was erected there without any consultation with the public. The idea of this monument was to form concrete-level terraces by drastically levelling the sloped site and digging out a large part of the ancient cemetery where the notable cultural persons were buried in the 17–18 c. In 1995, the monument from 1983 was taken away becoming probably the shortest 12-years' time standing memorial structure in Lithuania. The remaining concrete slabs then lost their original meaning and were left abandoned for quite a while attracting graffiti enthusiasts and becoming an underground gathering place (Fig. 1 a). The memory of destroyed cemetery stimulated considerations to find a relevant method for conservation of the Reformation garden, paying a tribute to the cultural achievements of the Reformation in Lithuania in 17–19 c. In 2014, Vilnius City Municipality commissioned the project for the Reformation Garden conservation that was completed by 2018 (Fig. 1 b).

When the project was still in the early phases of development, it was met by strong opposition from the particular public groups. The authors have recorded, saved and analysed the material of numerous meetings, publications and internet discussions on the quality of the mentioned project. For this study we have used the material of Surveys (940 respondents) carried out in 2018 by the public initiative group. In addition, we have summarized the information provided on the web portals and the contributions of 39 active members of the public in Facebook group. The substantive opinions were identified based on the analysis of project's critique and were grouped according to the four groups of criteria. Having analysed the public opinions we structured the expressed opinions into four groups of criteria (Table 2).

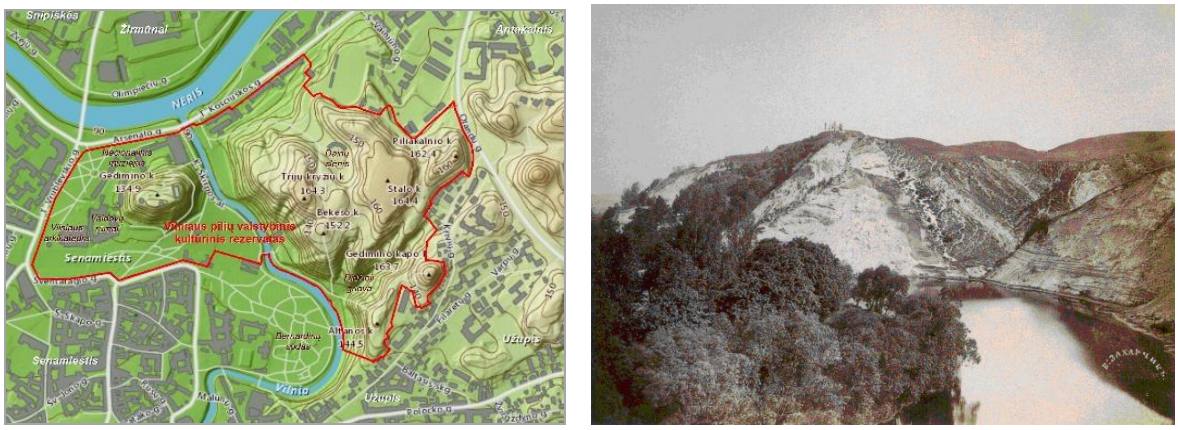

Figure 2. a) The location of Hills Park. Source: VilniuGo http://www.vilniusgo.lt/2016/11/05/vilniaus-kalnai-kalnu-parkas/ b) Historic view to the Hills Park in the 19th c. Source: Vilniaus pilių valstybinio kultūrinio rezervato direkcija http://www.vilniauspilys.lt/bekeso-kalva

TABLE 3

The criteria distinguished through the analysis of critique of the project for the Hills Park conservation

Criteria groups	Opinions of different stakeholders		
	The public	The project professionals	The client (agency)
Ecological	Save all existing trees Protect present biodiversity Protect the slopes	Trees cutting for opening panoramas and paths Slope erosion management	Targeted tree cutting Protected biodiversity Reinforced slopes
Socio-functional	Application for visitors using the minimum measures and resources	Walkways, stairs and walking bridge between two ridges New recreational and sanitary facilities	Adapted to the flow of visitors, seeking convenience for all
Aesthetic	Minimalism	Variety of vistas Using the Baltic signs and symbols	Left to professionals to decide
Collective memory	The memory of pre-Christian culture, not excluding the later cultural layers	Neutral information system	Multi-layered expression of memory, highlighting missing historical information

The second case is the Hills Park covering the area of 33 ha, which is a part of Vilnius City Castles Historical Cultural Landscape Reserve. The area recently called a park in the early years of establishment of Vilnius City in the 14th c. was a holy forest with pre-Christian worship place. It is an impressive hilly landscape area with the remains of former medieval and earlier castles, archeologic remnants of ancient settlements and fortifications, eventually overgrown with forest and during the past decades used for public recreation and big events. Hills Park is in the city centre near the Old Town of Vilnius, at the confluence of the rivers Neris and Vilnia. The highest points of the area offer wide vistas and picturesque cityscapes (Fig. 2). The project for conservation of the Hills Park (2017 - 2019) has created quite a resonance between the citizens and the professionals in the field. In the case of Hills Park project analysis, the minutes of the two public hearings and three expert working group meetings were analysed, and the authors of the article took part in public meetings in person (Table 3).

The third analysed case is Sapiegos Park with the area of 8 ha. It is one of the oldest parks in Vilnius City, founded by the Grand Hetman of Lithuania Jonas Kazimieras Sapiega (1637 - 1720) in the 17th c. and built in Baroque style in the picturesque city district Antakalnis. In the 18th c., the park was expanded to the South, and the part of initial landscape plan was installed onsite. During the third development phase, French architect Joseph Poussier (1781-1821) has rebuilt the park and adapted it to the needs of a military hospital during the Russian occupation of Lithuania in 1810. Since the establishment of the military hospital, the park has been turned into an enclosed area used exclusively for the recreational purposes of the sick. In 2014, the former hospital buildings were adapted for innovative cultural and community activities. In 2014–2018, Vilnius Municipality has commissioned the project for conservation of the baroque part of the park. Although the conservation of the Sapiega Baroque Park was taken for granted for few years, and many landscape architecture

Figure 3. a) Project of the Sapiegos Park conservation. Source: Citify https://citify.eu/ b) View of the Sapiegos Park main gate and palace. Source: BNS https://www.lrt.lt/naujienos/nuomones/3/1071730/vilniaus-istorijos-daugybe-aistru-keliantis-antakalnio-sapiegu-parkas-ir-rumai

TABLE 4

The criteria distinguished through the analysis of critique of the project for the Sapiega's Park conservation

Criteria groups	Opinions of different stakeholder groups		
	The public	The project professionals	The client (municipality)
Ecological	Save all existing trees Save present biodiversity Mind climate change issues	Partial tree cutting for restoration of the parterre, the paths, the fountains	Provide only the necessary tree cuttings Follow the principles of sustainability
Socio-functional	Adapted to local community recreation	Combination of representative, cultural, and recreational activities	Representative, cultural and educational activities
Aesthetic	Present environment with preserved authentic elements from the baroque period	Aesthetics of Baroque Gardens Art with new elements	Aesthetics of Baroque Gardens with some new elements
Collective memory	The present state shall dominate	Baroque period artefacts from the Sapiega period	Actualisation of values and heritage from the Sapiega period

practitioners and cultural heritage specialists have supported it, the local community opposed the idea of rebuilding the baroque park and Vilnius City Municipality halted the project (Fig. 3). In practice, Chiara Santini raised the same question that we met in the Sapiegos Park: "How to adapt a historic garden to contemporary transformations and challenges? To what extent is it necessary, in a process of restoration or rehabilitation, to consider these issues? [13]. In this study, we have analysed 155 recorded views of community representatives and experts on the conservation project and its implementation process (Table 4).

Results and discussions

We reassigned the generalized and code-based criteria to each of the cases examined above. With this kind of derivative data, we were able to compare the distribution of criteria among the stakeholders (Table 5). The results of the study showed that in all cases opinions differ on ecological criteria as citizens prefer full protection of all existing trees in the present ecosystem. Moreover, professionals and clients prefer the selective tree protection when valuable in all senses plants are maintained. In terms of social criteria, in the case of the Reformation Garden and the Sapiegos Park, the public members place emphasis on free open access of the territories and the diverse needs of various communities, and other actors give priority to the regulated access and the fragmented representation of the relics during the development timeline.

The results of this study reveal how opinions of three stakeholder groups distribute through the groups of criteria and indicators in the analysed landscape conservation projects. All stakeholders outlined the social indicator S4 "Representation" in most of the analysed cases. Environmental indicator E3 (Selective protection) and Aesthetic indicator A2 (Interpretation) was outlined in six cases. All stakeholders have mentioned the "Current memory" indicator M1 in the Memorial criteria only once. While accounting the matching or overlapping opinions, the Hills Park has collected most of overlapping responses – 12. Moreover, the Reformation Garden had collected least matching opinions – just five indicators matched in opinions of different stakeholders. The study showed that the

TABLE 5

The distribution of criteria among the cases and the stakeholders

Research objects	Reformation Garden			Hill's Park			Sapiega Park		
Time span	18 - 21 c.			12 - 21 c.			17 – 21 c.		
Stakeholders	Public	Designers	Client	Public	Designers	Client	Public	Designers	Client
1	2	3	4	5	6	7	8	9	10
Summary for different stakeholder's groups									
Ecologic	E1 E2	E3 E4	E3	E1 E2	E2 E3	E2 E3	E1 E2	E3 E4	E3 E4
Social	S1 S2 S3	S2 S3 S4	S4	S1 S4	S1 S4	S1 S4	S1 S2 S3	S3 S4	S3 S4
Aesthetic	A2	A3 A4	A2	A1 A2	A1 A2	A1 A2	A1 A2	A3 A4	A3
Memorial	M2	M3	M4	M2	M2	M2	M1 M3	M4	M4

longer is the anthropogenic historic timespan of the place (from the 12th to the 21st c.) the less controversy it brings for the stakeholders, as compared to most-recent manmade places. The longest historic timespan of the Hills Park brought relatively most of the general acceptance in social, aesthetic and memorial criteria (Tab. 5 col. 5−7). We could observe that during the long time the ecosystem to great extent has re-naturalised the place. The more recent is the landscape's timespan the more different and opposing opinions come from the public for its conservation project. The most recent Reformation Garden that date its last planning phase to the 90ties of the 20th c. caused most of controversial reactions from the public that was in general opposing to the methodic conservation and fragmented representation of the lost elements of the park (Tab. 5 col. 2−4).

From that perspective, we assume that the cultural landscapes with more development phases deserve extreme attention and professionalism of landscape architects as to work out and widely communicate the general aim, the concept and the methods of conservation during the preliminary design phase. In all three analysed cases, the ecologic criteria collected most common visions, and the aesthetic – least common assessment (Tab. 5). The rebuilding of *de-facto* lost natural or built elements by the new materials and technologies, as offered by the project designers but rejected by the public, should be generally avoided giving priority to the careful conservation and fragmental representation of the remaining authentic material. Treatment of the remaining original trees should mostly rest on a good maintenance and protection of their livelihood, sometimes using currently available technologies. Some gentle interpretation of the past periods and lost authentic material may be applied in such projects following careful and attentive public consultations.

Conclusions

In all analysed cases, public discussions were mostly active at the final phase of the design work. The study shows that a wide-ranging discussion with the public on the basic goals, principles and methods should start even before the planning and design process for landscape conservation begins. Discussions are intended to exchange opinions on public acceptance of the modern conservation paradigms, allowing for a more responsive and creative use of landscape architecture methods and tools. In a cultural landscape where, over time, memory acquires a generalized expression, it is worth limiting itself to minimal design means without destroying the remaining harmony of the represented memory. Multi-layered cultural landscapes require specific landscape architecture tools and techniques that by design means integrate all periods of landscape memory into a sort of a "reading story." The issue of managing the process of conserving historic parks is a major challenge where we face ecological and social priorities. It is very important to identify the needs of public space users and define possible contradictions between different stakeholders. Complex research and constant moderation of the dialogue between opposing sides can help to face those contradictions and prioritize certain design solutions. The science and professional practice of landscape architecture should continue to seek for the best principles and methods of landscape conservation while constantly communicating them to the general public, neighbourhood and also sharing it with professional community. The character of changes that each place has gone through in its lifespan as well as its location in respect to the city centre may have impact on the public interest in its future. The structured, professional and objective opinion from the landscape architects community that was missing is very important to reveal the qualities of the place and the proposals. The question of organising the public presentations, hearings and discussion meetings is a separate question with many important aspects to consider, e.g. balancing the representation of different public groups, and the authors will continue analysing these aspects in the following research. The analysed cases are in different phase of implementation and we expect that the expressed opinions will have positive impact on their quality.

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Kopsavilkums. Pēdējo divu gadu laikā Viļņas pilsēta ir piedzīvojusi izrāvienu sabiedriskajās debatēs par pilsētas atvērto telpu. Pētījumā analizēti vairāki ainavu arhitektūras projekti, kas saistīti ar kultūras ainavas atdzīvināšanu, kā arī izraisījuši aktīvas sabiedrības debates. Pētījumā konstatēts, ka agrīna diskusija ar sabiedrību, ainavu atdzīvināšanas procesā, noved pie pozitīviem lēmumiem par ainavas izmaiņām.

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Undefined lands: A review of their role as an underexplored resource of landscape

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Abstract. Landscape areas have spatial discontinuities, such as vacant land and leftover spaces. Undefined lands present a compelling area for landscape research, aesthetical experience, and development of cities which discuss irregular and unexpected aspects in landscape settings. Having lacked a formal definition of undefined land, this study aims at proposing keywords of undefined lands, a comprehensive review of knowledge, and definition. In order to promote new aspects of such spaces in the future research, the study conducts a systematic analysis of 65 peer-reviewed papers for their temporal trends, locations, methods, key authors, and commonly studied aspects. Results show the production of vacancy and the temporary use of undefined lands as an opportunity, and a flexible method of regeneration. An increase in publications over the past 30 years demonstrates that leftover space is an evolving subject. Although socio-ecological aspects are the most effective, serious gaps are mentioned in the literature considering aesthetical and ecological qualities in leftover spaces formed by visual, sensorial (hearing, touch, smell, taste), and cognitive perception. These gaps in the literature suggest that it is important to understand the potential effects of repurposing citizen's ideas about interventions in which to use leftover spaces. Having identified the knowledge gaps, undefined lands are suggested as a significant sub-discipline in landscape research.

Keywords: vacant land, landscape, leftover space, brownfield, lost space

Introduction

Having considered cities from the landscape perspective, they are highly fragmented lands that consist of built and vacant areas, developed and derelict buildings, and infrastructure [71]. Over the past few decades, urban shrinking, decentralization, population decline in cities and deindustrialization have created a large number of residual spaces [23]. While vacant lands associated with the slump, crime and unsightly spaces [1; 2; 7; 19], they can be used as an ecological, economic and social resource [3]. For the restoration of cities, space generation and multiple of other functions, Lefebvre presents a bottom-up solution, and indicates the role of the inhabitants [40]. Moreover, Wikströms carries out research concerning the meanings of vacant lands and their function in landscapes [85; 86], concerning public space for transgressing the boundaries in a segregated city as a part of an interdisciplinary project [87].

A large body of literature recognizes that negative connotations of residual spaces can overshadow positive aspects [16; 17; 18; 33; 41; 50; 52; 57; 60; 82; 89]. In fact, studies show that vacancy can be found as a valuable resource for local communities, economies, and environments [7; 38]. Therefore, there has been an increase in transforming these informal spaces into formal spaces in the landscape [8; 71]. Such transformations could improve sustainability, by increasing the balance among different aspects of social well-being, environmental protection, and economic development (Wu, 2010) and provide opportunities for the redevelopment of urban activities like employment and housing [75].

As researchers have seemingly neglected, undefined lands elicit many questions. Could such informal spaces be viewed as an ephemeral and temporary space? How can vacant lands be of productive use? How can these informal spaces be defined globally? How does the literature view their characteristics in the landscape? What Kind of trends exist within the literature (temporal trends, spatial patterns, methods used, key authors)? How can the voids become productive building blocks for the city? What causes are associated with changes in vacant land supply? To answer these questions, this study advances a concise review of 65 peer-reviewed research papers, on what we call ‘undefined land’, a particular type of informal land.

Liminality and informality: defining undefined land

In general, these areas are not considered as landscapes. These alternative areas may include a sunken plaza, parking lots, flower-rich vacant lot, an overgrown roadside edge. At a larger scale, they may be found as abandoned structures or industrial sites [17]. They are not descriptive but constitutive, meaning they do not describe a space that is a ‘dead zone’, but they produce it [13].

During the Modern era, standardized designs, the focus on the consumption of commodities and primary living conditions distanced users from communal interaction. According to Trancik [82], lost space was the result of designing isolated and mass-produced spaces when the standardized designs trumped concerns for user values and community, eroding traditional forms of urban space.

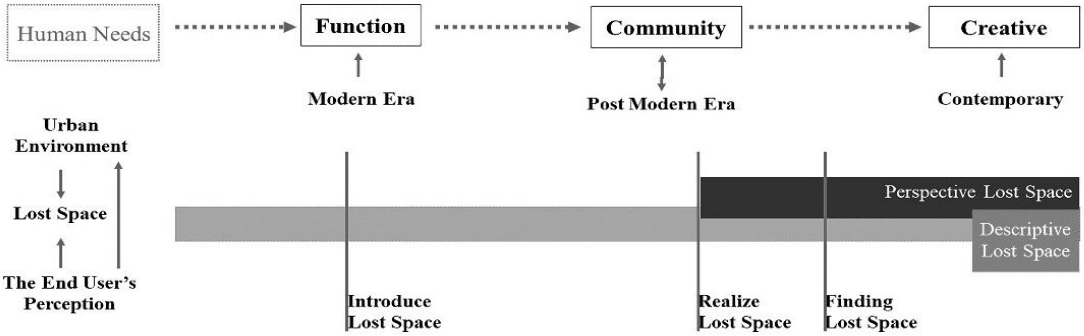

Fig. 1. Definitions of undefined lands - Source: Adopted form [42]

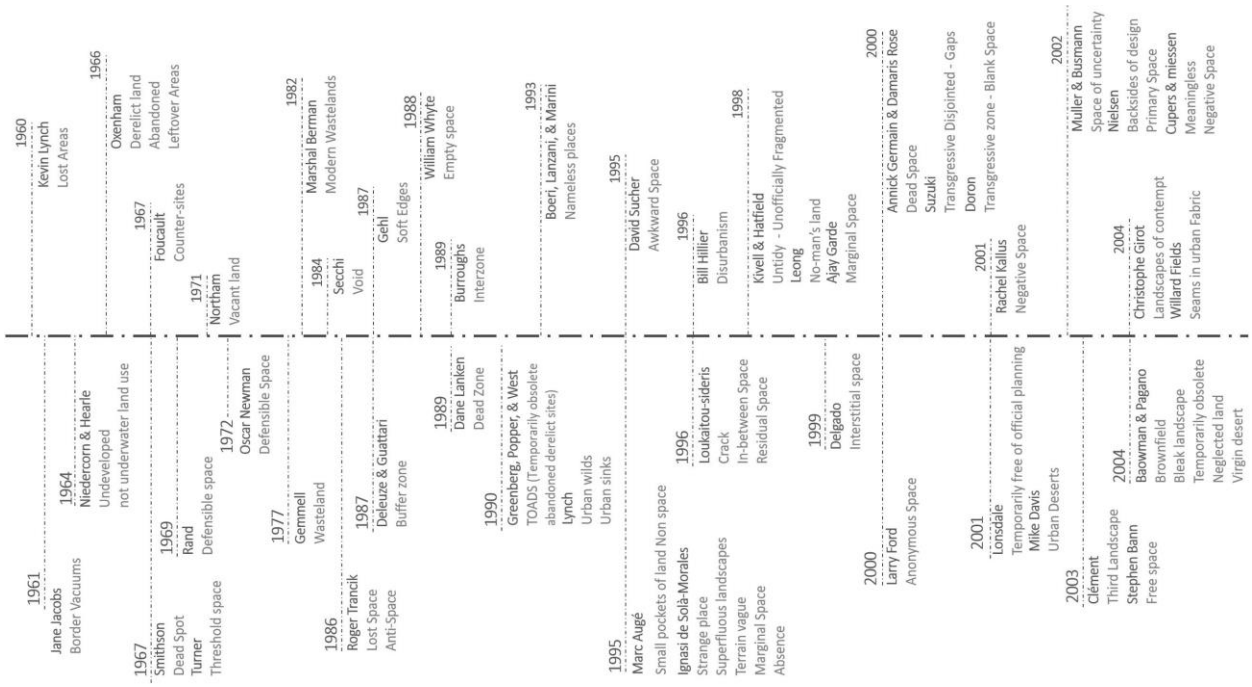

Fig. 2a. Terms used to refer to undefined lands [created by authors, 2019]

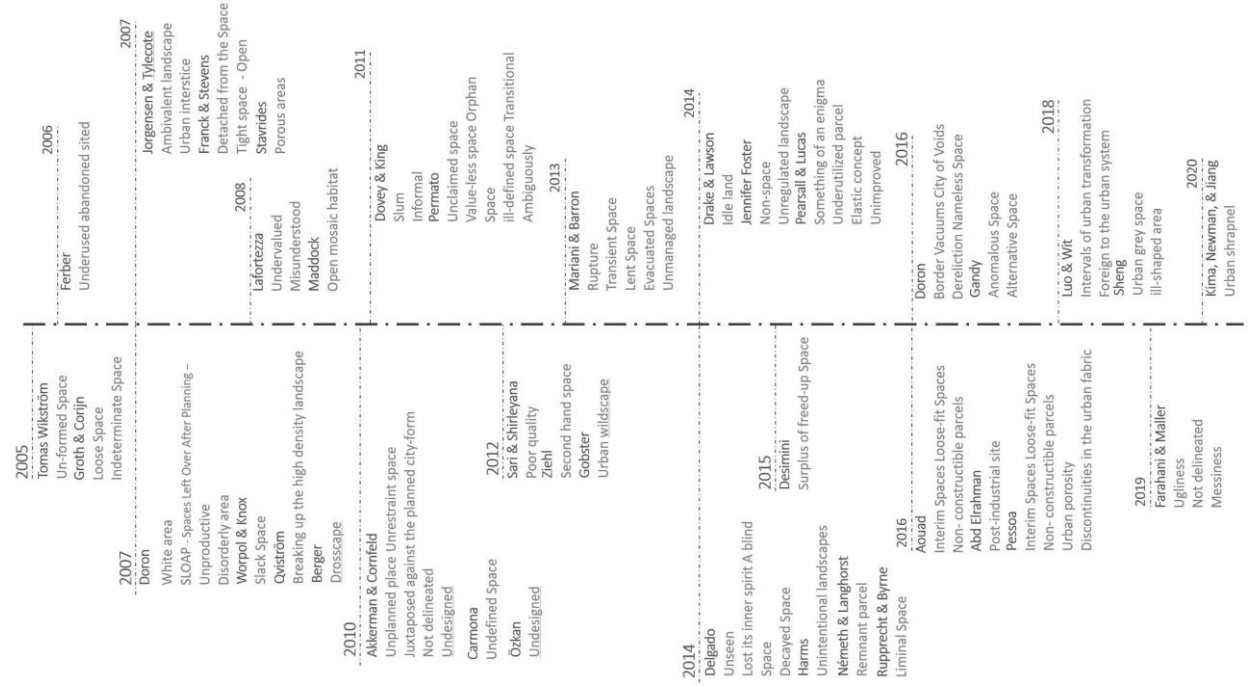

Fig. 2b. Terms used to refer to undefined lands [created by authors, 2019]

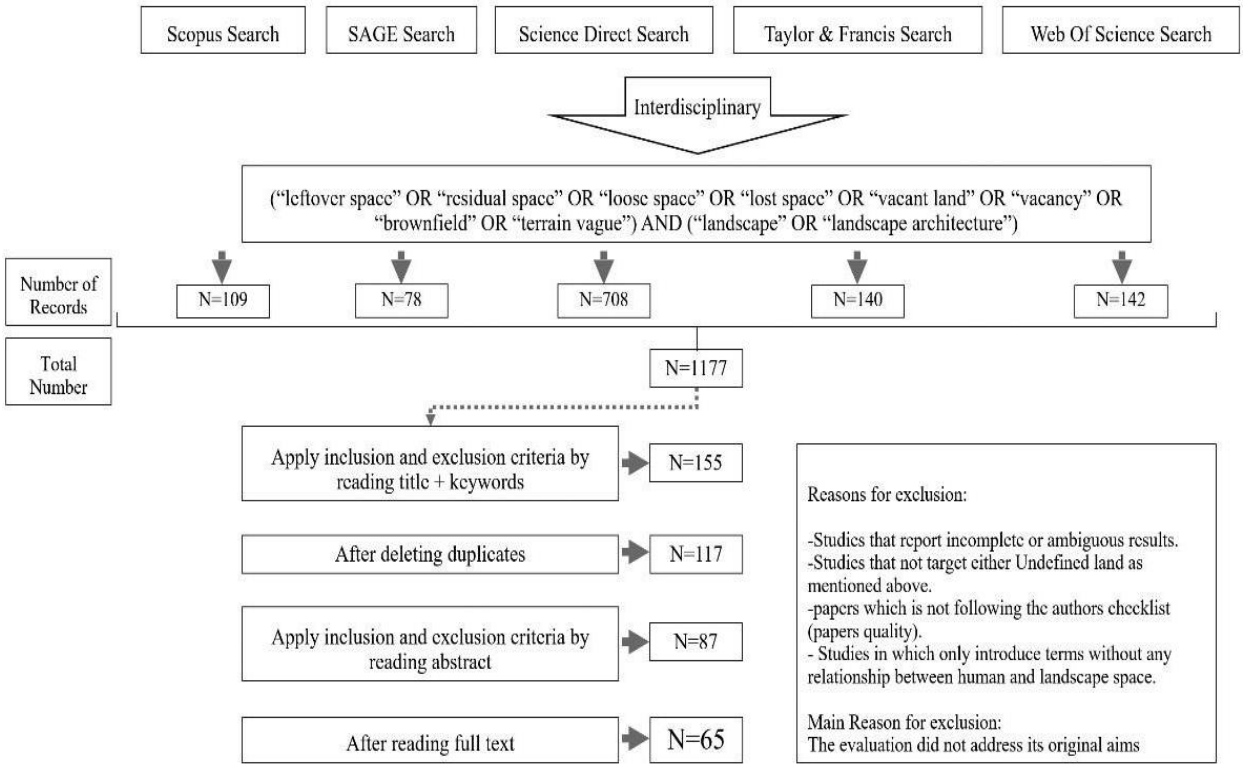

Fig. 3. The automatic search process and number of selected papers in each stage.
** Due to the literature, the most common keywords were selected for automatic search [created by authors, 2019]*

According to Figure 2a, 2b, vacant lands and abandoned structures are widely acknowledged with different definitions and prescriptions because there is no specific accepted definition [7]. Therefore, this section has been conducted trying to include almost all related literature to undefined lands. Krier [29] argues that the spaces in any urban environment could be considered as urban spaces. Also, according to Trancik [82], 'Space becomes place when it is given a contextual meaning derived from cultural or regional content' (1986). What this implies is that when a space is deprived of value and meaning, it becomes lost. Accordingly, what is a necessity is to present the concept of undefined space and its aftermath, which is reflected in the landscape. So far, various reviews have been conducted trying to include almost all keywords of undefined spaces in landscape architecture and to be more explicit to summarize the theories expressed over time. Figure 2, adapted from Fields [14] illustrates the theorists, the years of publications, along with the theories underpinning their research.

Materials and Methods

The existing systematic review is conducted in accordance with Pickering and Byrne's [66] approach. Since the result of the reviewed literature is not used for future statistical analysis, this method varies greatly from a classic meta-analysis. Yet rather relevant information extracted from published papers is used to explore geographic, methodological, and theoretical aspects in the literature [66]. To investigate the terms which are fully illustrated in Figure 2, the authors conducted a study and found out the most relevant terms. The selected search terms seem to be more general and they were mostly used in the first phase of the study. The search terms were used to find matches in article titles, keywords, and abstracts during an automatic search in electronic data sources. As indicated by the guidelines [30], the accompanying techniques were utilized to create the most applicable automatic search terms.

Having combined both the methodological search and deletion of duplicates, 65 papers were checked. Gibbs [20] mentioned the studies conducted, based on a qualitative paradigm through an analytical process. The articles were analyzed from the viewpoint of the case studies, focus areas, research methods, and common studied aspects.

According to Figure 2, this study sought to have a time limitation on the search (from 1960) and selected the research papers that were expressly targeting undefined land to further potentially related publications that were not returned in the databases. To be selected for the process of analysis, research papers had to follow one of the two inclusion criteria: (1) aim either terms used to refer undefined lands or (2) inquire about a relationship between human and landscape space.

Results and Discussion

Having taken the above mentioned steps, followed by the deletion of duplicates, 65 selected papers were gathered among 28 journals. As it is shown in Figure 4, the most original research papers were published in Urban Forestry & Urban Greening (9), followed by Landscape and Urban Planning (9), Cities (8), and Landscape Research (8). This suggests that there is a widely recognized interest in this topic in various types of journals.

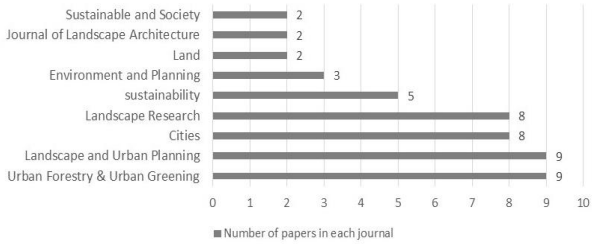

Fig. 4. Journals containing most undefined land papers [created by authors, 2019]

Main aspects studied

As presented in Figure 5, a variety of aspects can be detected over the systematic review. Additionally, having examined the trends in the literature review, the main idea, and the papers' findings are discussed. The selected original research papers targeted a variety of aspects, such as ecological (20 papers, 30.7 %), social (18 papers, 27.6 %), economic (15 papers, 23 %), and shrinkage and gentrification (15 papers, 23 %) being the most prevalent, respectively (Figure 5). Multiple aspects of undefined lands were investigated in most selected papers. Pickett, Cadenasso, and Grove [68] examined a promising new tool for promoting the integrating between ecological and socio-economic aspects.

Having considered heterogeneous patches which have complex combinations in landscape, Jacobs [27], Machlis [46; 65], Gottdiener and Hutchison [22], Pickett et al. [67], Holling [26], Walker et al. [84], Folke [15], Cadenasso [9], Pickett et al. [69], determined a definitive relationship between ecological and social aspects of undefined lands across the urban landscape. Moreover, the rethinking of the unstructured landscape such as community gardens, vacant lots, informal parks and edges of freeways that could sustain socio-ecological interaction [37], drew Sutton and Kemp [79] to demonstrate that undefined lands could generate from 'places of inequities' to 'places of transformation'. Therefore, when it comes to revitalizing communities and landscape change in undefined lands, previous studies suggest a bottom-up approach in contrast to traditional top-down approaches.

Most socio-economic variables seemed to be less influential in shrinking cities than in growing cities [39] and as shrinking cities have experienced depopulation, resulting in a remarkable economic crisis [24], many studies seek to consider multiple aspects in their research. Easier land assembly and lower development costs based on existing infrastructure [54] are the most critical factors in investigating economic aspects. However, opportunities to redevelop vacant land by improving its ecological and social value [25; 28; 36; 38; 54; 72; 73; 74; 90] is the most common aspect in this systematic review. Therefore, there are several embracing issues, brought by multidisciplinary views on leftover projects.

According to Loures [44], the creation of multi-functional areas in undefined lands could be the chief concern in the redevelopment process. In this regard, being aware of the community perceptions to inform landscape regeneration projects and to consider the social, economic, environmental, and cultural functions are essential. However, through assessing the vacant lot uses, the physical indicators (size, shape, location) and socio-ecological characteristics, planners may be able to underpin the resilience approach and sustainable concepts in undefined landscapes [38]. While the discovery of ways became necessary to develop the urban environment in a more sustainable way, our view of intervention is near-sighted [8]. Urban decline offers great potential and can become the embodiment for urban green space and ecosystem services rather than being abandoned relics of failure.

To intervene in undefined lands and increase the liveability of urban neighborhoods, it is essential to fuse the fractured literature of how such spaces are used or the reasons why they are not used [50]. Although some policies with top-down strategies showed that the social value of these vacant land projects are not relevant to the sense of residential environment, it seems feasible that tactical urbanism, as an effective treatment for redesigning the unused lands, could transform these spaces into a meaningful place with a sense of community [4].

For instance, the literature suggests apart from other frameworks, to understand landscape aesthetics, the context of informal urban lands and their connection to a more extensive system of social aspects are crucial for the perception of the value of leftover spaces programs [78].

The significance of this analysis is that it sheds light on a new perspective of vacancy as a substantial socio-ecological resource, which can enhance health and promote quality of life for communities [31]. Moreover, studies on urban structure, function, and value can promote decision-making and, consequently, improve environmental issues and human health [34].

Temporal trends of the selected papers

As illustrated in Figure 6, the number of original research papers has significantly risen over the last 30 years, with over 86 % of papers published since 2012. Considering the potential for recreation, the undefined land has aroused considerable interest in 1986 [82]. A reason for the increasing interest may be the ongoing urbanization, shrinking cities [47; 54; 73], the continuity of the place [45; 90], and social and ecological perspectives [43; 80].

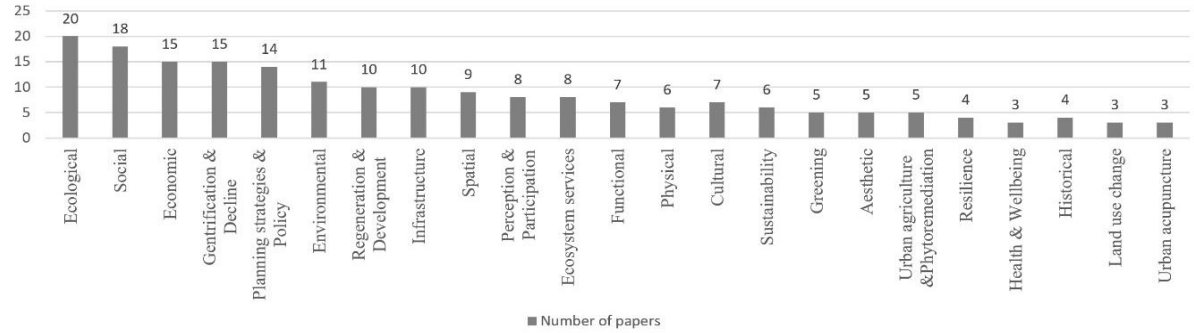

Fig. 5. The issues that have been an emphasis on various different papers [created by authors, 2019]

Geographical patterns of the selected papers

Interestingly, the geographic distribution of researchers around the world shows that the USA (35 papers, 53.8%), has the highest number of researches around the world. Afterwards, the UK (9 papers, 13.8 %), Canada (4 papers, 6.1 %), Japan (3 papers, 4.6 %), and Germany (3 papers, 4.6 %) are the most cited.

Undefined land type

Based on the terms used in the title, abstract and keywords, the distribution of the selected research papers shows a clear bias in favour of vacant land (33 papers, 50.7 %) followed by all vacant land, vacancy and vacant lots (51 papers, 78.4 %) and brownfield (16 papers, 24.6 %). The enormous number of selected papers may be due to the use of several types of keywords in general, but there is also a focus on one or two specific types. Moreover, these 65 papers had hardly compared different terms used. The scarcity of literature on the demolished, unintentional landscape, residual nature, and lost space keywords are considerable.

Types of papers by their Methods

As it is shown in Figure 8, the most common method was case study (27 papers, 41.5 %), followed by descriptive – interpretive (15 papers, 23 %), and literature review (15 papers, 23 %). Although the case study method is used extensively, there appears to be no accepted systematic case study method used per se. This means that researchers usually combine the case study method with methods such as literature review or certain statistical analysis like GIS. The reasons for the popularity of surveys may be due to the flexibility of collecting qualitative, quantitative data. Based on the in-depth analysis, as illustrated in Figure 8, authors used different methods.

Many researchers used mixed methods, and Figure 8 indicates that questionnaire-based surveys were favoured in many studies [5; 10; 44; 78; 81]. According to Rupprecht and Byrne [71], the GIS-based method was not a common research method for investigating informal green spaces; however this systematic review reveals an increase in papers with GIS-based methods (7 papers, 10.7 %) used for analysing the case studies.

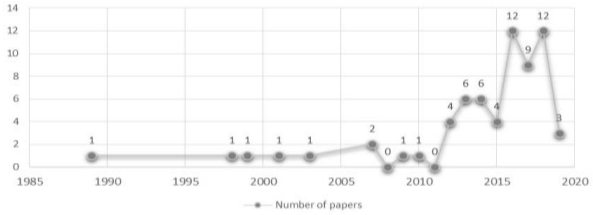

Fig. 6. Publication history of papers on undefined lands [created by authors, 2019]

Likewise, papers often combined interviews (7 papers, 10.7 %) with observations or questionnaires. Behaviour mapping (1 paper, 1.5 %), land allocation (MOLA) (1 paper, 1.5 %), Decision support systems (DSS) (1 paper, 1.5 %), and photography (1 paper, 1.5 %) are still comparatively rare.

The first and key authors of the selected papers

Some researchers have contributed to multiple original research papers. Newman, has analysed vacant land trends by region and city-type [55], designed with considering specific conditions such as using high ecological potential [59], structural connectivity of the landscape [56] and explored the possible interconnections [58], the importance of corridors and small-scale green spaces [56], urban elasticity [55] and transformations of physical change [57; 58; 60].

Kim investigated gaps in knowledge about vacant land and properties which can be integrated with other green infrastructure [31], potential redevelopment of the vacant land [32], energy costs and structural value of the trees [33; 34] and also expanded a comprehensive typology for introducing and perception of the potential of informal spaces as a part of urban landscape space [35].

Pallagst studied how manufacturing was affected by industrial transformation [62], green infrastructure development, and focusing on rightsizing [62]. Németh discussed the urban decline and community benefits [53], and presented the cases that could have temporary and short-time, transformational, flexible, dynamic and experimental responses to undefined lands [54]. Although the influence of industry on creating voids in the urban structure is invaluable, Unt introduced these places and evaluates the magnitude of the impact of small design interventions as urban acupuncture, on the activities carried out by the users [83].

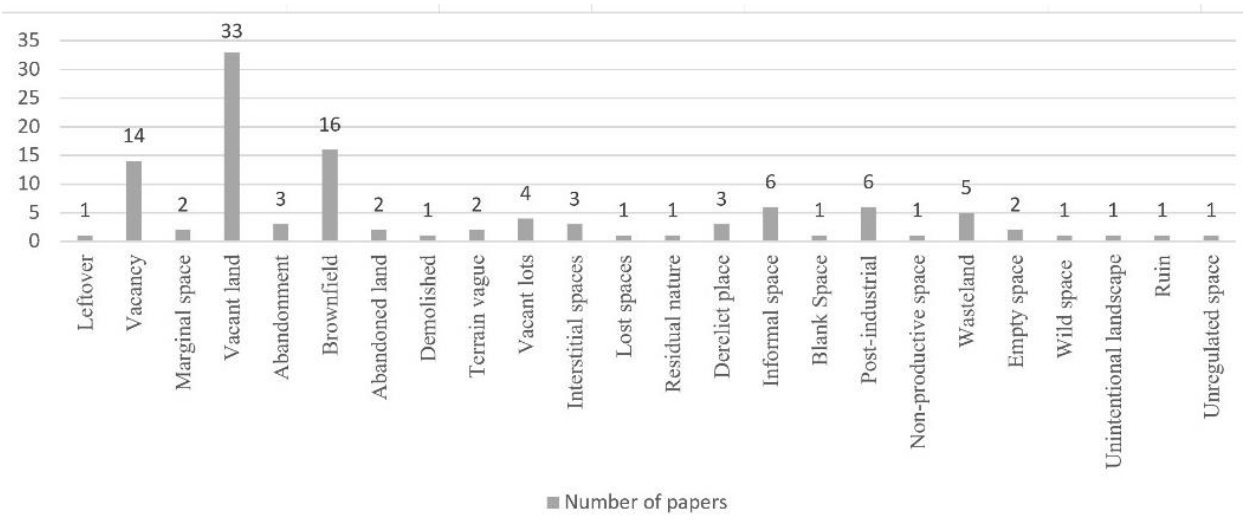

Fig. 7. Distribution of papers by targeted undefined lands type.
**Number of papers does not add up to 65 as papers may use more than one keywords [created by authors, 2019]*

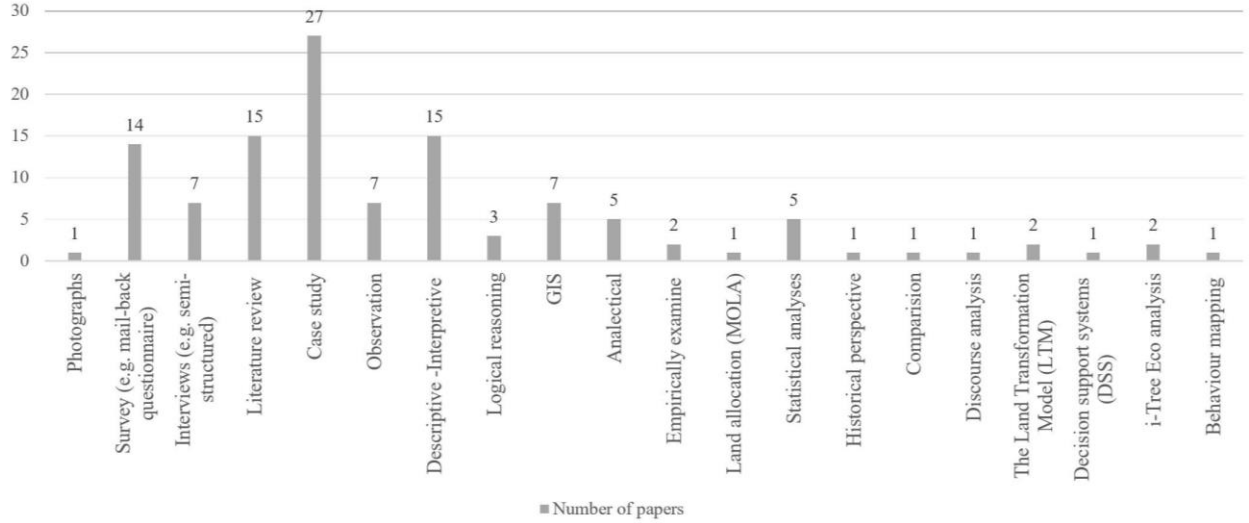

Fig. 8. Methods used in papers on undefined lands.
**Number of papers does not add up to 65 as papers may use more than one method [created by authors, 2019]*

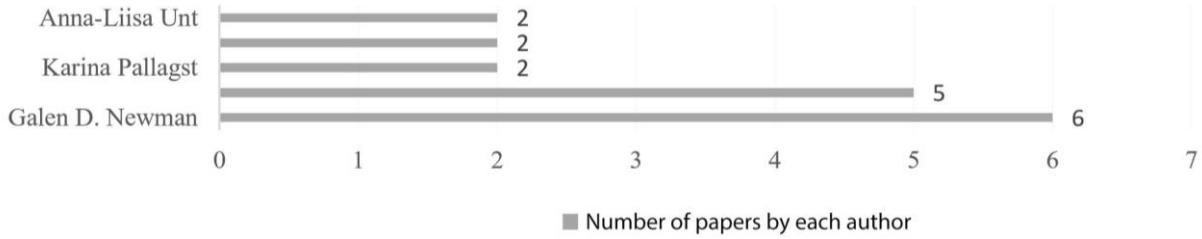

Fig. 9. Authors publications of papers on undefined lands [created by authors, 2019]

Geographical gap

About 28 papers mentioned in the studies were conducted based on a case study method to investigate regions and cities all over the world. The geographic distribution of case studies illustrates a clear bias in favour of the USA (28 papers, 43 %), followed by Germany (4 papers, 6.1 %), Japan (3 papers, 4.61 %) and papers that investigated multiple cases (3 papers, 4.61 %). Although 8 papers (12.3 %) did not mention any cases; so far, numerous studies were conducted by analysing different cases (57 papers, 87.6 %). However, they do not seem to be sufficient in geographical distribution, and papers from countries such as China with numerous studies, are significantly rare.

Positive or / and negative

While many assumptions are based on inherent negative aspects of vacancy and that vacant lots symbolize shrinking cities, urban decay or urban problems [51; 55; 76; 88], this systematic review demonstrates that undefined land can provide alternative spaces for small interactions [81] as a long-term strategy or temporary process [48], also, areas for redeveloping

the site, extensive growth in planning's paradigm [24; 62], and an opportunity for communities to reclaim and revitalize their neighborhoods [63].

This study suggests that undefined lands appear to play an important role in landscape change, with a complex and sometimes contradictory process. Moreover, some interdisciplinary processes such as biodiversity guidelines in undefined land restoration provides a remedy resulting in considerably improved outcomes [64]. As defining the restoration is a critical component, the land is considered as the first stage of the physical process [3]. The perceived vacancy of undefined lands can be negatively interpreted as crack and dereliction [70].

This systematic literature emphasizes on redeveloping vacant land as a special opportunity to regulate shrinking cities in whether it occurred in the past or concerning future challenges. What it implies is that urban agriculture and green infrastructure might facilitate landscape spaces. As shrinking cities could be viewed as laboratories for experimenting with new frameworks of planning under crises and changing conditions [62], having been utilized more effectively, urban leftover spaces can supplement different types of open spaces for residents.

In shrinking cities with large amounts of undefined land, it is necessary to develop city-scale strategies [11; 21]. Before undefined lands can be occupied, they must be designed and constructed. This attention has tended to be affirmative; the temporary approach is a successful activator for urban voids [12], which are considered unutilized. In this concept, the temporary use of undefined lands, with their temporal and spatial fluctuations, should be analysed in the urban development process [49] as an opportunity for regeneration and renewal [6; 77]. On the other hand, cities with large numbers of undefined lands need more restructuring rather than the temporary approach. Temporary functions as well as a programmatic overlay can activate the vacant land and articulate them with the urban context as a catalyst for places of disinvestment [12].

Directions for future research

In addition to including various types of undefined lands, future studies should attract a variety of research methods. Ethnographic methods have only been used in very few cases. As Nijhuis exemplifies the potential of GIS as a tool for enriching the analytical framework in landscape [61], it may provide a valuable starting point for undefined global initiatives.

In order to use an interdisciplinary approach to assess lost spaces restoration and pose recommendations for future projects, it is necessary to synthesize mixed methods. Mixed methods also may provide new insights such as understanding resident's interaction with informal spaces, perception of community in defining these leftover spaces, and investigating transformational opportunities in landscape from a multidisciplinary perspective.

The research indicates the limitations of comparison of international case studies. The importance of these gaps is because of various types of spaces in each region, especially the variation in different cultural contexts. There is a requirement for further focus on cross-cultural research. So far, numerous studies have been conducted analyzing different cases; nevertheless, few studies have been conducted in undefined spaces in Asia, South America, and Africa. We could recognize that the scarcity of research papers in these regions could be attributed to being limited to English as the language used for this review.

In future studies, the socio-economic and physical characteristics of each parcel should be considered in order to reach an effective management strategy which is not only evidence-based and also requires long-term progress.

Otherwise, the process of regeneration is led to vague ideas in landscape planning [56].

Conclusion

To understand the role of leftover spaces in the landscape, this review has systematically analysed English literature on a group of quasi-public spaces termed ‘undefined spaces. An increase in publications over the last 30 years demonstrates leftover space as an evolving subject in landscape research. Serious gaps mentioned in the literature include the lack of studies about leftover spaces outside the USA and Europe, as well as the scarcity of studies on community well-being, small urban spaces, integrated infrastructures, abandoned structures, and a framework for intervention. Key themes emerging from the literature include social and ecological approaches in resilience; environmental stewardship, difficulties in knowledge participation for realizing leftover space potential; and the differing perception and participation of residents in landscape spaces that may lead to gentrification and urban decline. Key methods used include case study, literature review, and descriptive-analytical methods, but participatory, discourse analysis, LTM, DSS, and behavior mapping remain scarce.

Given the ambiguity, informality, and the fragmented nature of urban landscapes, a large number of such spaces are probable to occur within cities. This limited understanding of human perception in terms of landscape preference on leftover spaces is reflected in the trends we found in the literature.

Various theories on the preference of different ages, gender, culture, professionals and non-professionals, residents of different places, etc. could be considered for analyzing these spaces. Since preference could create a significant interaction between the citizens and the environment, it could have a specific role in landscape preference and interpretation of urban intervention in informal spaces.

Although socio-ecological aspects are the most effective, serious gaps in the literature include the lack of studies about considering aesthetical and ecological qualities in leftover spaces that are formed by visual, sensorial (hearing, touch, smell, taste) and cognitive perception. Therefore the gaps in the literature (considering both socio-ecological and aesthetical aspects) on undefined lands suggests that it is important to understand the potential effects of repurposing citizen's ideas about both short- and long-term interventions in which to use those spaces.

This study focused on the generation of vacancy and the interim use of undefined lands as an opportunity and a flexible method of regeneration. Despite having a common approach to inventories or classifications, vacancy cannot be addressed through a 'one-size-fits-all' approach. Likewise, these spaces should never be read from a single perspective, as a combination of different criteria and multiple lenses determine an initial framework to the perception and represent the specific characteristic of undefined spaces.

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Kopsavilkums. Pētījumā uzsvars tiek likts uz ainavtelpas teritorijām, kas atstātas novārtā un veido telpiskos pārtraukumus. Rakstā sistematizēti un analizēti 65 recenzējamie dokumenti, atbilstošas tendences, atrašanās vietas, metodes, autori un biežāk pētītie aspekti. Pētījumā konstatēts, ka trūkst oficiālas nenoteiktas zemes definīcijas, līdz ar to pētījumā tiek izvirzīts nedefinētu zemju atslēgvārdu, definīciju izvērtējums un izpēte.

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A breakthrough in landscape design: from traditional garden of ancient despots to the avant-garde “garden of Cubism”

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Abstract. The article traces the process of moving away from traditional landscaping with millennial traditions to the revolutionary breakthrough of the 1920s, based on the views of the avant-garde and Cubism. One of the oldest traditional examples is the Chinese Garden, whose principles have been developed and refined over the millennia. In the Chinese garden and the natural environment in general, architecture played a secondary role, only emphasizing the beauty of the landscapes. It was the natural environment that dictated appearance of small architectural forms – pavilions and arbours, their sizes, silhouettes and colouristic solution. The maximum conservation of natural landscapes without human intervention was aimed at the so-called landscape English garden. Instead, the French garden was aimed at improving the natural environment of man, that is, the parks are provided with regular planning, the introduction of green with molded crowns, flower beds with a complex pattern, widely used included in the regular composition fountains. All of these techniques were discarded in the early twentieth century, when, in parallel with the revolutionary changes in urban planning and architecture, there were dramatic changes in landscape design. In the so-called “garden of Cubism” of the period of constructivism-avant-garde, the natural environment no longer plays a major role, such a role is taken over by architecture and sculptural forms, and the garden is actually transformed into an installation.

Keywords: tradition, avant-garde constructivism, cubism, landscape design

Introduction

Since the appearance of the garden/park as a separate object, we can trace the development of its three main functions: utilitarian, symbolic and artistic. Also, the emergence of a garden / park as an object of landscape design is impossible without artificial elements introduced into the natural environment. The ratio of artificial and natural in the structure of a garden / park also changed at different times and in different countries.

Despite the differences associated with climatic conditions, historical events, cultural and artistic traditions, it can be argued that in fact until the 1920s, that is, before the period of constructivism and avant-guard, approaches in the landscape design remained hereditary and traditional.

The first systematically organized examples of landscape design emerged in ancient Egypt and Assyria, especially this trend has evolved since ancient times and in China. Landscape design in European countries in the past centuries is most often associated with landscape art of two types – French based on regularity and English based on natural picturesqueness.

Urban development in the late 19th and early 20th centuries clearly showed that the traditional concept of an urban garden / park as a green island in an urban environment could not provide favorable conditions for most citizens and should therefore be replaced by the concept of integrated urban landscaping. This made the utilitarian component of the garden's function optional and paved the way for the emergence of the "garden of Cubism", which is perceived almost exclusively as an art object, and most of the living plants in it have been replaced by artificial installations.

Despite the visual avant-gardism, such a garden can also be considered a creative rethinking of previous landscape trends, namely the French regular park. The basis of the "garden of Cubism" is partly the philosophy of French regular park, with the principles of emphasized geometry, creation of deep perspective views and human dominance over nature. The same signs are present in the gardens of Cubism, albeit on a different compositional basis, in other forms and in other materials. The "garden of Cubism" can be considered a turning point in the history of landscape design, which reflected the changes that took place in society in modern times and were also reflected in art and architecture.

Today, landscape design is developing in many directions, and one of the areas is the "modernist garden". Its difference from traditional landscape design, where architecture, small forms complement the beauty of natural environment, is that natural environment no longer plays a major role, and the garden itself begins to resemble not a landscape, but a work of art. Under the influence of modernist views, the attitude towards the notion of artificial garden was transformed during the twentieth century. It turns into a garden installation, then into a garden sculpture.

Matherials and Methods

For the study, the authors drew on sources that highlight the diversity of approaches in landscape design. The works devoted to general questions of landscape design were analyzed [4; 11; 12; 14]. It was used as a basic publication on Chinese traditional

Fig. 1. Hanging Gardens of Babylon (Semiramis' gardens). This hand-coloured engraving, probably made in the 19th century after the first excavations in the Assyrian capitals, depicts the fabled Hanging Gardens, with the Tower of Babel in the background. Source:https://en.wikipedia.org/wiki/Hanging_Gardens_of_Babylon#/media/File:Hanging_Gardens_of_Babylon.jpg

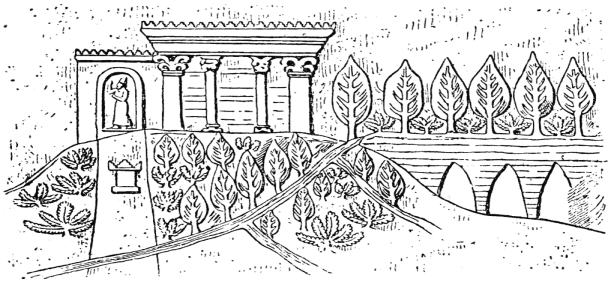

Fig. 2. This copy of a bas relief from the North Palace of Ashurbanipal (669–631 BC) at Nineveh shows a luxurious garden watered by an aqueduct. [https://commons.wikimedia.org/wiki/File:Hanging_Gardens_of_Babylon.gif]

landscape architecture [15] and its effects on European landscape design – works by E.H. Chang [3], X. Fang [5], Yu. Ivashko and S. Li [7], Q. Li [9], J. Lui [10]. Scientific publications by Y.-M.Allain and J.Christiany [1], A.Baraton [2] are devoted to French regular parks. Sources from the history of English landscape parks [16] and gardens of the period of constructivism-avant-garde, where Ye. Zabelina's publications became the basis [17, 18], were also studied.

The following methods were used: the method of historical analysis, the method of comparative analysis, the graphoanalytical method.

Traditional gardens of Ancient Egypt, Assyria and China

These civilizations formed their own approaches to landscape design, but they were all based on the exaltation of nature as the highest manifestation of harmony and beauty. The most ancient testimonies of the gardens of ancient Egypt include testimony related to the reign of the Pharaoh woman of the New Kingdom of Queen Hatshepsut (1490/1489 – 1468 BC, 1479 – 1458 BC or 1504 – 1482 BC), which contributed to the strengthening and prosperity of Egypt. The relief at the funeral temple of Hatshepsut in Deir el-Bahri depicts an expedition of five ships to the country of Punt in 1482 – 1481 BC for the transportation of the myrrh-trees of the Amiris and the planting at the temple for the worship of the god Amon. It is obvious that such a temple garden performed primarily a symbolic function.

Perhaps one of the most famous examples of a garden based on revealing the natural beauty of living plants was the hanging gardens of Semiramis in Babylon in the kingdom of Assyria – one of the world seven wonders (Fig. 1).

There are several legends that link the creation of the gardens to either the king of Babylon, Nebuchadnezzar (605 – 562 BC), who allegedly arranged them for his wife, Amitis the princess of Lydia, or the queen, Semiramis, who ruled Babylon before Nebuchadnezzar more than 200 years earlier, in the 9th century BC. However, discussions about the reality of the Semiramis gardens existence are still ongoing. Some scholars adhere to the version that the Hanging Gardens were created by another king, the Assyrian king Sinnaherib (704 – 681 BC) in the capital of his Nineveh state.

According to the descriptions, the Hanging Gardens were at palace, the palace itself had very high walls supported by stone columns, and trees and plants were planted on the terraces so that the landscape looked like a mountainous country. The gardens were square in shape with a side close to 120 meters and the height of all tiers was about 60 meters. According to the chronicles, the arrangement of the gardens required great ingenuity, since the depth of each tier of the garden was such as to provide normal space for tree roots and water for irrigation was supplied from the Euphrates.

The Sennacherib garden was considered a miracle of its time not only because of the plants and trees beauty, but above all because of the hydrotechnics high level for supplying water to all terraces with plants. Sennacherib's grandson Ashurbanipal depicted a garden on one of the palace reliefs (Fig. 2).

Wherever the legendary garden was located, it can be noted that it performed both a utilitarian (ensuring contact with the natural environment, creating a favorable microclimate) and symbolic function (emphasizing the social status of the ruler). Despite the fact that the mass of artificial structures was much greater than the mass of natural components (plants), such a garden mimicked the natural environment, rather than opposing itself to it.

A distinctive style of landscaped gardens has emerged and over the course of three millennia formed in China, evolving into many varieties – imperial gardens, private gardens of famous people, gardens at temples and monasteries, public gardens. The main task of the garden in China was to create a mood of calm and harmony by idealizing the landscape with artistic means. The "joy of the park" is mentioned in the ancient Chinese canon of the Book of Songs. The characteristic Chinese garden was surrounded by walls and contained ponds, picturesque groups of stones, located in certain places small architectural forms – pavilions. The garden

was planned in such a way that during the walk along the paths the viewer would discover elaborate species views in which nature was the main role, and architecture merely complemented it.

The planning of imperial gardens was especially careful. Thus, in 1267, an imperial park was established in Beijing, which had two artificial lakes. And in the eighteenth century, another Yíhé Yuán Yiheiuan Palace Park (Carefree Leisure or Harmony Conservation Park) was also built, with an artificial lake and an artificial hill, according to the traditional Chinese art genre "shang shui" ("mountain-water") as a traditional symbol of Universe creation.

In the 5th – 6th centuries there was a division into imperial, private and public gardens. The main difference between the imperial gardens and the non-imperial gardens was immensity of the imperial ones and privacy of all others.

There were certain canons of arranging a traditional Chinese garden, the main one of which was the inability to simultaneously see the entire space of the garden, which "decomposed" into a series of separate spaces with species pictures and small architectural forms. Walking through the garden, a viewer watched the landscape change all the time. Such an inability to simultaneously view the entire expanse of the garden obeyed the ancient principles of "Feng Shui", according to which natural landscapes have a positive effect on human condition. According to the "Feng Shui", the specific partitioning of the spaces prevented evil spirits: in architecture this role was played by multi-folded malleable screens, in landscape art by natural elements such as hills or trees. Views from different points were considered separately – from the main entrance, during walks in the garden, even from neighboring areas.

Unlike the Ancient Egyptian and Assyrian gardens, which were based solely on aesthetic and hedonistic values, the Ancient China garden has, above all, a strong philosophical and religious foundation for Taoism, Buddhism, and Confucianism. The main difference between the Chinese garden, both Egyptian and Assyrian, and European English and French, was that the garden in China acted as a means of dialogue between nature and human as a cultural origin which did not involve human intervention in the natural environment. It was thought that although the garden is an artificial creation of human, it does emit light of the beauty of nature. The garden in China was considered in the context of three major ontological components of the world: Sky, Earth, and Human, and it was believed that the most complete person is realized in art. Unlike in Europe, in China, humans did not act as the supreme creation of God, empowered to change the world around themself and their needs, humans only improved the natural properties of things by means of their aesthetization. This approach of minimal interference with the natural properties of things implied the poetization of such elements that were not considered to be the bearers of aesthetic properties in European countries. For example, sacred boulders of the original form from the bottom of Lake Taihu, which outline their analogies with Taoist calligraphy, were used as the "best decoration" of the Chinese garden. It is interesting that these bizarre boulders with holes were not of the nature: stonecutters knocked holes in them and lowered to the bottom of the lake, and after years the water destroyed the traces of treatment and gave the holes a natural character.

Analyzing the rich content of the landscape views of many ancient Chinese gardens, one can see the borrowing of some ways of views creation from traditional Shang-shui paintings, which is also due to the fact that well-known artists sometimes worked to order as landscape designers.

The garden gradually expanded its features: to the picturesque landscapes, water masses, local greenery with exotic birds (garden-pleasure) were added such elements as stones for slides, brought from other countries trees and plants, complicated compositions of gardens, where they began to display miniature real lakes and mountains.

With each change in the dynasties, the role that relied on landscape gardening changed somewhat.

During the reign of the first emperor Qin Shi Huang a park was considered a prototype of the empire and was believed to have the same properties.

During the reign of the Han Dynasty, in addition to the function of the symbol of the socio-political system of China, parks and gardens are given an esoteric function, since this period is associated with the cult of immortal hsien (in Chinese Taoism – immortals who achieved divinity through devotion to Taoist practices and teachings) and immortality. In the Han parks and gardens, "divine mountains" appear where they are thought to live immortal, arbors are dedicated to the immortal, and slopes are sown with sacred plants.

Gradually, these tendencies move from imperial gardens to private and public gardens, but there they lose most of the social and esoteric component and in most cases are directed to the artistic enhancement of the natural environment by means of landscape design and small forms architecture.

Particularly flourishing of landscape art came from the Ming Dynasty, when having a garden of its own became a sign of a person's elite affiliation. In parallel, this causes the small forms of architecture to blossom when pavilions for different types of occupations are spread – for painting, music and singing, for reading, meditation, relaxation, tea parties, guest meetings. Gardens actually take on the role of an important character of poetic works and plays, and people travel to see the gardens described in literary works with their own eyes. A popular theme of painting of the Ming era is the landscapes of the gardens, written either at the request of the owner or in honor of an event.

Gradually, some varieties of gardens are formed – large-scale imperial gardens of closed type, surrounded by walls and located over a large area, private gardens in estates – a small area, but with miniature views and

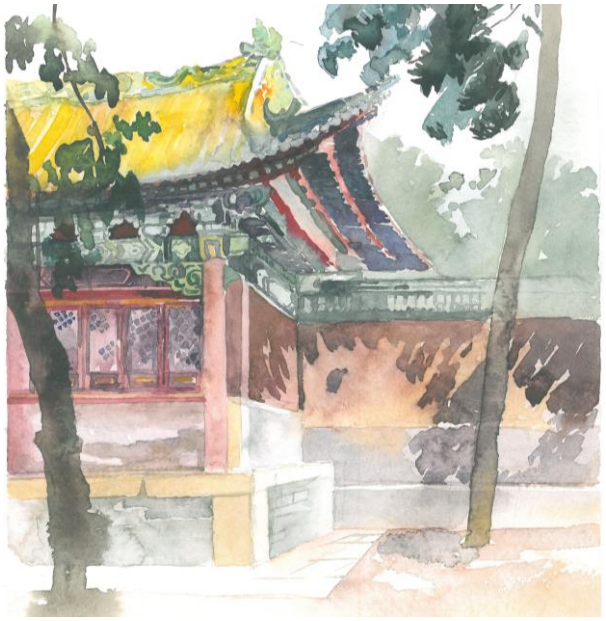

Fig. 3. Fow Anh Gong Pavilion of the Gugong Ensemble (Imperial Palace of the Ming and Qing Dynasties) in Beijing, China, [watercolor by Chang Peng, 2019]

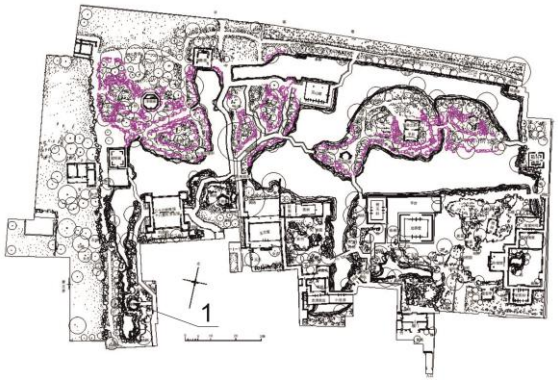

Fig. 4. An example of traditional privat Chinese garden – "Zhuozheng yan" ("Garden of the retired official") in Suzhou: 1 – the arbour "Pavilion where you can see the shadow of the tower"

Fig. 5. "Pavilion where you can see the shadow of the tower" at "Zhuozheng yan" garden in Suzhou, China. [watercolor by Chang Peng, 2019]

small landscape detail, public gardens for shared use, as well as natural gardens, as well as they were somewhat improved by enhancing the properties of the landscape and supplementing it with small architectural forms. The gardens at temples and monasteries, which were aimed at seclusion, meditation and the performance of religious rituals, were a separate type. Such gardens include the Tanjou and Zetai Gardens in Beijing, the Jin Temple Garden in Taiyuan in Shanxi, the Western Garden in Suzhou in Jiangsu, the Linxi Temple Garden near Xihu Lake in Hangzhou, Zhejiang Province, Weibamyao Garden in Chengde City, Hebei Province.

Temple and monastery gardens were distinguished by their increased size and in the area of the territory approached the imperial gardens, and their style provided the maximum naturalness of landscape views.

As Chinese architecture as a whole was shaped according to the social hierarchy, certain types of gardens were given some functional significance, in particular, the scale of the Imperial Garden site was another expression of the exclusive position of the Son of Heaven on Earth (Fig. 3). The area of such a garden could be at least several hundred hectares. Typical examples are the gardens at the Bishu Shanzhuang palace and park ensembles in Chengde City, Hebei Province, the "Gardens of Perfect Clarity", and Iheyuan Park at the "Three Mountains and Five Gardens" complex in Beijing.

The Bishu Shanzhuang ensemble originated in the early Qing era under Emperor Kangxi. The residence performed state functions and testified that the "heavens are squeezed by the emperor's bosom" with the richness of the layout and the appearance of the individual buildings.

In order to show all the grandeur and scale of the empire in one residence, to represent northern and southern landscape views within the same park, the area of lakes (modeled on the picturesque landscape of Jiannan with imitation of some well-known landscape paintings), the plains area (steppes of the Great Wall of China) and the mountain area (picturesque mountains of northern China) were distinguished.

The special role in creating the ideal of a private Chinese garden belonged to the city of Suzhou itself, which was due to many positive factors: the favorable climate of Suzhou, located south of Yangtze River on the shore of Lake Taihu, inhabited the East Chinese Jiangsu Province, the wealthy cities landscape gardens in private estates (Fig. 4, 5).

Thus, the landscape art of ancient civilizations was based on the maximum use of the nature aesthetics, although the share of artificial components in them could be quite high.

French regular and English landscape park

Although the concept of a regular park is associated with French parks, for the first time such parks appeared in Italy during the Renaissance (Boboli Gardens in Florence and Villa Medici Gardens in Fiesole) and were

transferred to the French territory in the early sixteenth century. The French regular, or geometric, garden or park (fr. Jardin à la française) was characterized by geometrically correct layout, emphasized by the symmetry and regularity of the composition. This was expressed in straight allées, which at the same time played the role of axes of symmetry, geometrically correct outlines of parkers and flower beds, giving trees and shrubs crowns forms of various shapes by forming crowns. Art of regular parks reached its peak during the Baroque period in France, in the 17th and 18th centuries, and the most striking examples were the gardens of Versailles, commissioned by King Louis XIV by landscape architect André Le Nôtre. This is when regular parks become an integral part of palace complexes. A specific system of terms for the regular garden components has also been formed. These include, in particular, a parterre for viewing from above, from the palace windows (square or rectangular, with ornamentation of low-cut ornamental plants and backfill of multicolored gravel or large fraction sand), a lawn parterre (with sod placed according to the design ornament and sand filling), a broderie (an ornamental garden made of sheared box hedges), a bosquet (a formal plantation of trees, set in strict regularity), an allée (a straight path or road with a line of trees or large shrubs running along each side), topiary (a specially trimmed shrub or tree, usually geometric in shape), patte d'oie (three or five allées (tracks) that come from one point).

With the decline of baroque and rococo fashion as opposed to the regular French park of Le Nôtre in the eighteenth century, an English landscape irregular park emerges. The promotion of these traditions as an embodiment of natural aesthetics was greatly facilitated by Jean-Jacques Rousseau, who re-designed in English style his garden in Ermenonville.

French and English parks expressed different canons of aesthetics in landscaping, having at the heart of a clearly philosophical idea – either the dominance of human over nature (French park), or the recognition of nature as the highest criterion of aesthetics (English park).

Although it is believed that the first landscape architects who laid foundations for English garden formation – William Kent and Charles Bridgman – were inspired by the landscapes of Poussin and Lorraine, but it would be desirable to pay attention to the influence of Chinese gardening traditions in this process, when in the wave of admiration for Chinese culture, the admiration for Chinese landscape gardening traditions and small Chinese-style architectural forms gradually emerges. In scientific sources we can find the characteristics of the English landscape park: emphasizing the natural aesthetics of the species pictures, lack of inspection of the whole park from afar, elements of unpredictability and surprises when a pavilion, grotto, lake or sculpture was hidden behind every turn of the alley. All this is combined with an intersection of Chinese elements (for example, Chinoiserie motifs were used by William Chambers in Kew Gardens).

In the second half of the eighteenth century, the most successful landscape architects of England became Lancelot Brown and Humphrey Repton, who finally abandoned the geometry of the park layout, the channels masked at small streams, used species pictures in the form of lawns with picturesque groups of trees. It is Humphrey Repton formulated the main features of a landscape park, based on free planning, use of natural landscapes features and improvement of their beauty, maximum naturalness of landscape compositions, integrity the garden elements, the secondaryity of architectural buildings and their subordination to the landscape in size. Inequality of terrain and presence of natural reservoirs are perceived as positive features. If the site terrain is uniform and flat, it is necessary to diversify it by filling artificial hills and arranging reservoirs and artificial ravines.

But on the same principles, traditional Chinese gardens have been created for thousands of years! Given that regular gardens were widely spread in Europe (emerged in the Renaissance period in Italy), and the aesthetic principles of landscape parks were not mentioned until the eighteenth century, it is possible to conclude that these processes continued in the period of admiration for Chinese culture. Significantly, through millennia of tea traditions, a keen interest in porcelain utensils, screens and small accessories, Europe became interested in Chinese culture as a whole, this fascination gradually extended to traditional painting, philosophical and esoteric teachings, and landscape architecture. Following the model of the Chinese pavilions, "oriental" arbors and so-called "tea houses" began to be built, and this gradually led to a total rethinking of the whole concept of a regular garden.

Thus, it is possible to draw analogies between how Chinese culture, from the seventeenth century, first through the realm of everyday life, and then at n cultural and artistic traditions, and how similarly Japanese culture from the second half of the nineteenth century gradually influenced the European and American culture, creatively "sprouted" in the European interpretation in the paintings of the Pre-Raphaelites, graphics and painters of the era of Impressionism and Modernism, became one of the origins of the modernist style and "prairie style" of F.L. Wright, highlighted in a number of publications by Mykola Orlenko, Yulia Ivashko and Shuang Li [7; 13].

The rapid development of cities in the second half of the 19th – early 20th century exacerbated the problem of providing favorable living conditions for most citizens. It has become clear that a traditional garden / park surrounded by densely populated neighborhoods cannot solve this problem. There is an active search for alternatives – from the concept of the garden city of Ebenizer Howard to the modernist concept of creating a system of continuous urban landscaping. In this way, the utilitarian function of a traditional garden / park seems to be "detached" from it and can be realized by other objects.

1920s gardens of Cubism as a challenge to the millennial traditional approach in landscape design

It was in the 1920s, after the First World War, after the revolutions, social upheavals, and the pandemic of the "Spanish flu" that the foundations of new social relations, new art, and new architecture were formed. Landscape architecture was no exception.

Such modern views of the garden as a work of art and design did not emerge in 1920s, but much earlier, at the beginning of the twentieth century, and a significant role in this process was played by modernist artists P. Picasso, E. Matisse, P. Mondrian, V.Kandinsky, K.Malevich.

In concentrated form, new trends were put into practice in the gardens of the 1920s, dubbed "cubist" or "architectural". Landscape design, as in art in general, also showed cubism, which is characterized by geometric shapes, the decomposition of a three-dimensional object into simple elements and its simultaneous image from different sides. Cubism concentrated on a flat two-dimensional plane of the surface, while rejecting traditional images of linear perspective, light-shadow relationships, and traditional imitation of the natural environment.

Cubists opposed the centuries-old tradition of three-dimensionality with a vanguard system of constructing images from two-dimensional fragments, when an object or a person was depicted from several points at once.

Scientific sources on 1920's avant-garde / constructivism draw attention to manifestations of a new style in urban planning, architecture and design, but much less frequently to mention avant-garde manifestations in landscape gardening and landscaping.

The avant-gardism of Cubism was based on a fundamentally new philosophy, expressed by P. Mondrian in one expression: "In order to approach the spiritual in art, one must at least imitate reality, because the real is the opposite of the spiritual."

Mondrian, who was originally considered to be a representative of high Cubism, later created a concept of a new style called neoplasticism, which defined the means of expressing aesthetics – four-dimensional space, limited by simple lines and shapes and three primary colors (red, yellow, blue).

It was these ideas of neoplasticism that were embraced by landscape designers, in particular, in the geometry of neoplasticism, they see the origins of designing hardwood floors and gardens, where architecture became not an artificial addition to the natural environment, but became equal to it.

Although in the 1920s architecture was affected by new trends of the avant-garde, landscaping even at that time retained conservatism, two standards of the park or garden were recognized – English irregular, picturesque, and French regular, with symmetrical arrangement of tracks, flowerbeds and clear lines.

That is why a landmark event in the dissemination of innovative ideas in landscaping was the holding in 1925 in Paris of the International Exhibition of Contemporary Decorative and Industrial Arts, which was presented by the French avant-garde school project Robert Mallet-Stevens

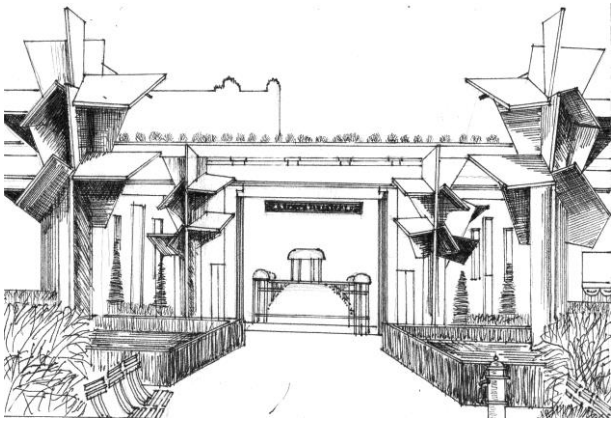

Fig. 6. "Jardin de l'habitation" by Robert Mallet-Stevens at the International Exhibition of Modern Decorative and Industrial Arts, Paris, France, 1925. [graphics by T. Kuzmenko]

garden of grass and concrete Jardin de l'habitation, where on four four-angle low platforms-flowerbeds there were four trees of reinforced concrete 4.5 m high (Fig. 6).

It is striking that the architect repeated the traditional layout techniques of the classic French garden, introducing such elements as regular planning, entrance arch, main central alley, along which were placed concrete trees. This example was analyzed in detail by architect Yelena Zabelina, who described him as one of the largest representatives of modernism alongside Le Corbusier, while noting the non-identity of the two representatives of the French Espry Nouveau, where for Le Corbusier, function and construction were more important, and for Mallet-Stephens – the aesthetics of structures and elements [17; 18].

This synthesis of functionality, constructiveness of form and aesthetic component just demonstrated the garden at the exhibition, located on an inconvenient site in the Eastern part of the Esplanade des Invalides over railway tracks with engineering networks. In fact, as noted by Ye. Zabelina, the presence of an elevated platform was forced to close communications from above. The replacement of living trees with reinforced concrete sculpture trees (Fig. 7) also became a forced measure, since the exhibition took place in June, which made it impossible to transplant adult trees of the same height [17].

It did not do without living plants, although here they played a clearly secondary role: under the concrete trees a lawn of grass and the so-called "stone roses"-houseleeks (Sempervium) were arranged.

The bold creative experiment of the architect found both ardent supporters in the faces of Italian futurists and critics – mostly French landscape designers who did not take such a radical rethinking of the traditional French regular garden.

Unfortunately, this garden was only an exhibit and was dismantled after the exhibition ended. Ye. Zabelina draws attention to an interesting fact: many of the photos are posed by models in the toilets by artist Sonya Delone, which also testifies to the resonance that caused this garden.

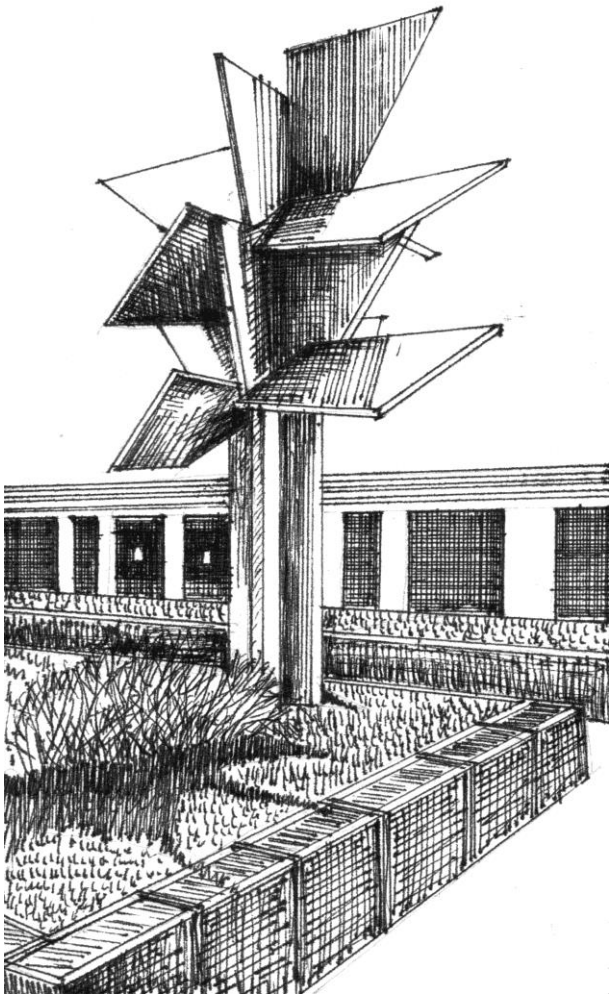

Fig. 7. Tree of reinforced concrete at the "Jardin de l'habitation" [graphics by T. Kuzmenko]

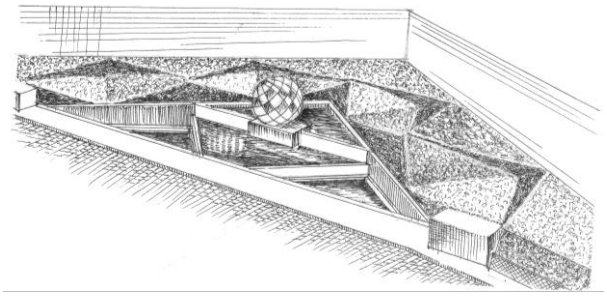

Fig . 8. "Garden of water and light" by G. Guevrekian at the International Exhibition of Modern Decorative and Industrial Arts, Paris, France, 1925. [graphics by A. Dmytrenko]

She believes that in reality the role of the Mallet-Stevens garden has proved to be much more multifaceted than the avant-garde object, and suggests analyzing it as an embodiment of art synthesis. Recalling the affilation of Mallet-Stevens to the cinema group, she compares the posing of models in avant-garde toilets against the backdrop of concrete trees with movie footage with thoughtful scenes and plot.

The second landmark project that accelerated the changes in landscape design was the project "Garden of Water and Light" presented by Gabriel Guevrekian, which was also dominated by simple geometry of artificial shapes of triangular flower beds, quadrangular structures and triangles of mirror glass and water (Fig. 8). The garden at the exhibition is located on the Esplanade des Invalides.

The architect deliberately rejected traditional gardening techniques, instead using the aesthetic possibilities of the rotating mirror-stained-glass sphere. Such independence from the seasonality of plants (from July to October, the time of the exhibition) was achieved by the composition dominance not of living plants, but of glass and concrete. Despite the small area of the plot, the garden did not seem small due to the original three-dimensional flower beds.

The idea of a garden based on a combination of simple geometric shapes also was embodied by Gabriel Guevrekian in the Cubist garden at Villa Noailles.

At the heart of the garden plan, which became the embodiment of Cubism in the arts, is the triangle on which the square ledges are placed.

Significantly, in this landscape composition, living plants play a secondary role, subordinating to the design elements, and thus creating direct analogies with the Mondrian canvases and the earlier project "Garden of water and light", which was the reason for the invitation to design a garden in the villa in the city of Hyères. It is significant that the villa was designed by R. Mallet-Stevens, so it is obvious that the avant-garde laconic architecture had to be enhanced by the same avant-garde garden at it.

Again, it is reasonable to compare the design of the garden at Villa Noailles with the black and white cinematography.

Such a comparison is all the more justified in view of the fact that R.Malle-Stephens participated in the creation of the avant-garde film scenery and at the same time authored the avant-garde villa project in the city of Hyères [17].

G. Guevrekian supplemented the villa's garden architecture with several optical effects, to which Ye. Zabelina also drew attention [17; 18]. It is significant that when planning the plot, the architect used a clear mathematical construction and on this basis created the illusion of perspective: from the side of the triangle base the garden seems longer than it really is, and from most points of view is not perceived as triangular in plan (Fig. 10). Although Cubist gardens are defined as a juxtaposition of the classic landscape design of previous centuries, in our view, they have reimagined in the new tradition and new material the features of French regular Baroque gardens. Thus, the French regular garden was also based on the principles of geometry with the dominance of straight lines, correct geometric shapes, and the regulated placement of living plants in accordance with the geometry of the composition of the garden or park, as well as the geometric forms of sheared crowns should express the dominance of human over nature. When designing a garden or park plan, it was possible to review it completely, in the long term, taking into account the laws of perspective and optics. In the Baroque days in France the garden became a place of performance, where performances, fireworks and balls were held.

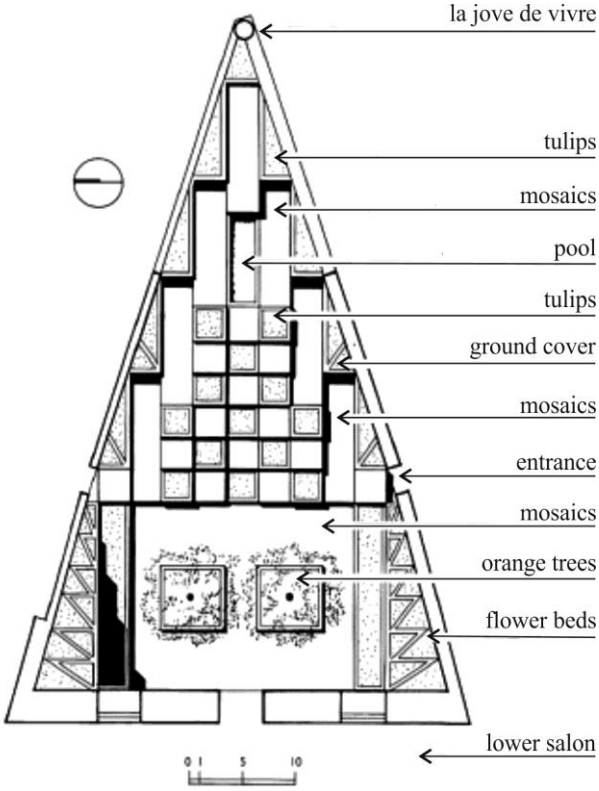

Fig. 9. Annotated layout of the garden at the Villa Noailles. Reconstruction by Dorothée Imbert after Agnès Fuzibet, Cécile Briole

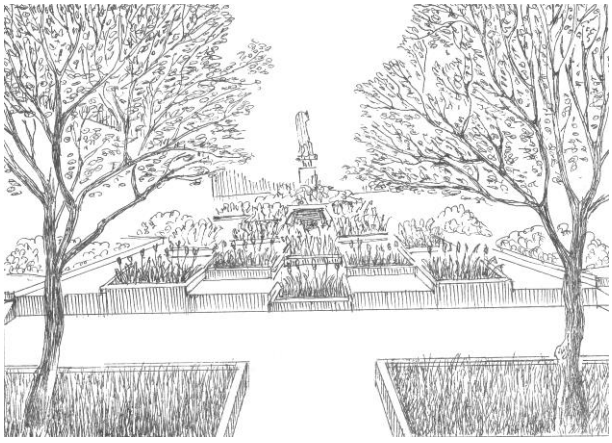

Fig. 10. The garden by G. Guevrekian at the Villa Noailles. View from lower salon [graphics by A. Dmytrenko]

Now let us analyze how these signs of a regular garden "sprouted" in the Cubist garden of the 1920s, in order to understand that the appearance of such a garden in France was not an accident. The avant-garde garden is also built on the basis of clear geometry, it is dominated by straight lines, each element – or flowerbed, or design element – is subject to a clear geometric arrangement, and the components of the garden have a delineated correct geometric shape (the difference from French regular gardens is the absence of ovals, curves and circles). The dominance of design elements over greenery also expresses the triumph of human over nature, in some cases it is actually a "Garden without plants". The garden of Cubism can be transformed into an element of performance (it is worth mentioning the fashion show against the backdrop of the avant-garde of R. Mallet-Stevens). In addition, such gardens were immediately planned with the possibility of their complete inspection, creating perspectives and in some cases – an optical illusion of increasing size (as in the garden of the Villa Noailles).

Modern "green architecture" and its relationship to landscape design

The influence of "gardens of Cubism" on the park concept development is difficult to overestimate. If the park was traditionally considered as part of a cultivated natural environment, where the percentage of greening was much higher than the city average, the 20th century was marked by the emergence of theme parks (amusement parks, sports parks, etc.), which do not stand out among the urban environment. A typical example is La Villette Park in Paris, opened in 1986, where architectural objects play a leading role.

At the same time, landscaping is becoming more and more decentralized, approaching the places of concentration of people – residential, public and industrial buildings.

Greening of roofs, vertical greening of facades and the presence of fairly large green spaces inside buildings (for example, conservatories in the building of the Commerzbank in Frankfurt am Main, Germany) – all this blurs the line between building architecture and landscaping.

In turn, it should be noted that the architectural environment, as "second nature" continues to replace the "first nature" and inevitably takes over the functions of the natural environment. The creation of biotopes is becoming not just a whim, but an urgent need, for example, when designing a system of precipitation removal from urban areas.

At the same time, the objects of the architectural environment – the so-called smart buildings – get the ability to respond to changes in the environment like plants (turn on and off the heating, adjust the sun protection elements or open and close windows depending on wind speed and temperature, as is the so-called "Gherkin" – the skyscraper on the 30 St. Mary Axe in London). This blurs the line between artificial and natural environments.

Conclusion

A brief overview of the landscape design emergence and development from traditional approaches to the avant-garde of the 1920s and the denial of the dominance of the natural component in landscape art demonstrates the different approaches that have been used in gardens and parks since ancient times. In ancient Egypt, the planting of sacred gardens near the temples was considered a worship of the gods, and mention of such expeditions to the rare trees were placed in the images on the walls of the temples. In Assyria gardens were created for aesthetic impression and enjoyment, gardens at the palaces of the rulers became the wonders of the world, along with architectural buildings,

because they needed a sophisticated engineering system for watering for irrigation, arranging the right place for planting trees. China's landscape gardening, based on a combination of Taoism, Buddhism, and Feng Shui principles, has gone its own way. In China, in the early stages of gardening, the garden was considered a reduced model of the Universe structure, a synthesis of the harmonious combination of nature and human in the infinite space (these functions were not performed by the gardens of ancient Egypt and Assyria, intended either to honor the gods) or to worship the gods.

A revolutionary breakthrough in landscape design occurred during the period of constructivism, avant-guard of the 1920s, when the role of human in the process of intervention in the natural environment is rethought, the garden is transformed into a certain installation, its layout is subordinated to clear geometry, and the place of living trees is occupied by trees while living plants are transformed into a certain neutral background in artificially created objects. The main goal of a Cubist garden is maximum expression of three-dimensional bulk elements geometry, introducing glass surfaces as an important theme.

Landscape design began to be seen not as a subordination of aesthetics and beauty regularities in natural elements, but as a synthesis of the arts, which, along with a natural component, devoid of dominant importance, takes advantage of the aesthetic possibilities of sculptural compositions, elements of design and installations that are ignited in space and time. On the example of R. Mallet-Stevens' garden were models of avant-garde clothing were photographed, we can prove that the aesthetic means also added performance, when the style of clothing models correspond to the stylistics of landscape design.

It was in cubism that the concept of the garden practically envisaged the emergence of a modern garden without living plants, such as Martha Schwartz's "Garden Design Collage" made of synthetic materials on the roof of the Cambridge Microbiological Research Centre.

The current state of landscape design and architecture is characterized, on the one hand, by "detachment" from the objects of their traditional functions (i.e. providing a favourable microclimate and communication with the environment can be provided by objects other than the garden / park, so the garden can be completely deprived of living plants), and on the other – the blurring of previously clear boundaries between landscaping and installation, landscaping and architecture, between artificial and natural environment [6; 8].

Of course, the turning point in changing the traditional paradigm of landscape architecture is the so-called "gardens of Cubism", the impact of which on the further development of landscape design is difficult to overestimate.

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Kopsavilkums. Rakstā analizēti un pētīti paņēmieni, kā no tradicionālas ainavas, pamatojoties uz avangarda uz kubisma principiem un uzskatiem, ainavtelpa dinamiski mainījusies. Pētīts ainavtelpas pārmaiņu periods 20. gadsimta sākumā. Ķīniešu dārzā un dabiskajā vidē arhitektūrai bija otršķirīga loma, tikai uzsverot ainavas skaistumu un vizuāli estētiskās kvalitātes. Dabiskā vide diktēja nelielu arhitektūras formu izskatu – paviljonus un lapenes, to izmērus, siluetus un koloristiskos risinājumus. Maksimālā dabas ainavu saglabāšana bez cilvēka iejaukšanās bija vērsta uz tā dēvēto ainavu angļu dārzu. Kopumā rakstā izvērtēti dažādi dārza stili, kas pie konkrētiem apstākļiem nodrošināja konkrētu plānošanas veidu, ieviešot izmaiņas pilsētplānošanā un ainavu dizainā.

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Importance and planning of pedestrian streets in urban environment

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Abstract. An increasing problem in cities is the growth of the number of motorised vehicles making the urban environment unsafe and unattractive and reducing residents' willingness to walk. The study explores the problems associated with the development of pedestrian-friendly infrastructure in the city. The importance of pedestrian movement in the urban environment was studied and several pedestrian streets in Latvia were analyzed. The method for evaluation of the quality of a pedestrian street was developed based on the summarizing and analysis of the information from the available literature sources. The method includes criteria that make a pedestrian street high-quality and easy-to-use public space that is suitable not only for walking but also as a multifunctional place for various activities. The authors have worked out recommendations for creating a spatial structure and landscape design in urban environment focusing on the necessity to install good quality and sustainable outdoor design elements, to provide environmental accessibility as well as to include pedestrian streets in the city's overall green infrastructure network, based on both social and environmental aspects. The recommendations provided can be used for the development of design guidelines and as educational material for landscape architects and urban planners.

Key words: pedestrian streets, sustainable city, public space, urban landscape

Introduction

The characteristics of a sustainable, functional, pleasant and strategically planned city are its suitability for pedestrian traffic and well-maintained urban environment on the whole. Street planning determines the quality of life in the city, but vivid public activities in the urban environment contribute to the development of the local economy. The population growth in cities leads to increased traffic intensity which contributes to environmental pollution with negative effects on climate change and public health in general. [10].

Historically, the streets have always been the place where most of the people's social activities took place: trading activities, gatherings, entertainment, socializing, demonstrations and children's games. At the start of using motorised vehicles for moving around, the number of cars and people on the streets was in balance, but as the time went on and technology developed, the balance disappeared [9]. Despite the fact that the fast pace of life and constant movement is one of the basic elements of the city, overcrowding and reluctance of people to walk caused unwanted side effects – monotonous urban landscapes, congestion, deteriorating air quality, general anxiety and insecurity [10]. The road transport and its place in the urban environment have been a key priority in urban planning for too long. Such urban development does not promote pedestrian traffic as the main mode of transport, it worsens the social and cultural functions of the city. The city's traditional core function, a meeting place, is threatened [10].

A pedestrian street is a linear structure in the urban environment, which serves as the mainpedestrian path in the daily route of residents, and, in addition, as a tourist attraction. A strategically planned pedestrian street encourages residents to move around on foot in the urban environment, creates a positive image of the city's public space and becomes a city's business card, by diversifying the urban landscape with green space and outdoor elements. A pedestrian street in the central part of a city connected to the most important nodes of the city may ensure an intensive flow of pedestrians not only during a warm season, but also throughout the year.

Contemporary trends in urban development focus on reducing and adapting to the effects of climate change, sustainable and healthy lifestyles and preserving existing values, therefore pedestrianisation policy is a way to keep up with the trends by encouraging people to walk without using cars on a daily basis. Pedestrian streets also form an accessible public space, which is part of the city's overall greenery structure [3].

Pedestrianisation strategy's aim is to revitalize city centres by creating a pleasant and functional public space, encouraging people to move in public space and communicate. As the number of pedestrians increase, it is possible to reduce the motorised traffic, thus decrease congestion, air and noise pollution in the urban environment [2]. Based on current developments and effective landscape planning of pedestrian streets, it is possible to create "green corridors", which harmoniously fit into the network of green infrastructure of cities.

Since the 1950s, there has been a growing concern that greenhouse gases, which increase global temperatures, could cause negative globalclimate change. Growing concerns and research over time into the effects of human habits regarding

Fig. 1. Benefits from pedestrian streets and urban infrastructure suitable for pedestrians [the author of the diagramme E. Mendzina]

climate change are a major reason for humanity to focus on a holistic approach to urban planning and management. [20].

On the one hand, global climate change affects the quality of life in cities, but on the other hand, functions of the urban environment have a significant impact on climate change. Climate change will have an irreversible effect on urban life, but it is also important to bear in mind that the extent of change depends on how cities function [20].

Walking is the most sustainable mode of transport and is a very important part of the city's transport system. Walking is the only way to get around that is completely free of charge and CO2-neutral [2]. Gains from increasing number of pedestrians and cyclists are the following: reduced congestion, improved public health, low costs, reduced air pollution and CO2 emissions. Urban residents prefer environmentally friendly modes of transport if urban infrastructure is appropriate, there are restrictions on the use of motorised transport, easy access to public transport [17].

Latvia has plans how to improve air quality by reducing CO2 emissions. For example, the National Energy and Climate Plan for the period 2021-2030 describes the desired situation to be achieved by 2030: the use of private cars is reduced in cities, and public transport is widely used. Pedestrian zones are linked with the public transport network to promote its use [14]. Benefits for society are the following: improved air quality in the city, increased well-being and health of the residents; good quality and improved urban space, attractiveness to tourists, entrepreneurs and local residents [15].

Data on the current situation in the capital of Latvia, Riga, show that in recent years not enough attention has been paid to the creation of new cycling infrastructure, but walking on foot is not friendly to residents and does not encourage residents to walk on a daily basis [16]. Therefore the Action Plan for Reduction of Emission of Atmospheric Pollutants for 2019-2030 has been worked out which includes the construction and improvement of pedestrian streets and pedestrian-friendly infrastructure in large city centres, as well as the implementation of pilot projects on traffic restrictions in some parts of cities as one of the directions for reducing air pollution in urban areas [7].

Pedestrian zones in the city promote a healthy lifestyle, make cities attractive to both visitors and local residents, strengthen the sense of community of local residents, as well as are environmentally friendly. Pedestrian areas help to preserve the cultural heritage and promote the economic development of the city [13, 6].

Streets adapted to pedestrian traffic create a suitable environment for social activities [1]. Vibrant public activities contribute to economic development by improving the economic situation of the city and its ability to ensure the personal safety of residents, parks, public greenery and attractive landscapes, cleanliness in the streets and proper waste management (Fig. 1.) [12].

The desire to walk on foot in the city is suppressed by unattractive and inconvenient infrastructure. Often, pedestrian sidewalks are too narrow or non-existent, cars are parked on pavements; there are various obstacles such as road signs and other information signs on the sidewalks. The long waiting time at traffic lights and insecurity of crossing streets at pedestrian crossings are also undesirable for pedestrians [13].

Walking is not only the most sustainable possible way to move around the city, but also a way to reduce inequality in society and to socialize with other people [6]. Streets, paths and other routes should be seen as a public space where city life takes place. Arcades, streets and sidewalks are places where city residents communicate, meet, wait, etc. The public space can be easily improved by placing the hard surfaced pavements, creating or adding greenery, placing functional outdoor elements [9].

The evaluation of recent events in the world and in Latvia related to the COVID-19 pandemic suggests that potential changes in urban planning and public space design are possible, which will also affect the design of pedestrian streets. Although major changes in planning trends will be seen over time, already now actions are taken to reduce a physical contact among people with the aim of limiting the spread of the disease, such as the

appearance of temporary cycle lanes in several European cities [4], including Riga [19], creating circles of physical distance in Domino Park, New York, the USA [11].

As regards Latvia, not so many cities have clearly defined pedestrian streets. The most impressive of them are: *Mazā Tirgus* street in Krāslava, *Rīga* street in Daugavpils, *Liepāja* street in Kuldīga, *Joma* street in Jurmala, *Tirgoņi* street in Liepāja, *Driksa* street in Jelgava. Speaking about Riga, the capital city, *Kaļķi* street in the old town is closed for cars in order create a pedestrian and cycling zone in the area from the Monument to Liberty up to *Skārņi* street in Old Riga. In 2011 the research was conducted to find out if it is possible to arrange a pedestrian zone in *Terbata* street, however, no further actions were taken [18]. The opinion was expressed that such streets as *Skola, Baznīca, Tērbata* and *Kr. Barons* in terms of their parameters are also suitable for conversion into pedestrian zones [8].

Transport Development Thematic Plan developed by Riga City Council mentioned that one of the main problems related to pedestrian infrastructure is the lack of pedestrian streets in the city, solutions for environmental accessibility and the low quality of public outdoor space [18].

At the beginning of 2020 Riga City Council decided to start the initiative for the period of one year: to close one of the city centre streets for car traffic on the first Saturday of each month, allocating it to pedestrians with the aim of revitalize the city centre, promote the mobility of residents and the development of the city [16].

The aim of the study is to identify the landscape quality, significance and planning principles of pedestrian streets in the urban environment, as well as to summarize and develop recommendations for pedestrian zone landscape planning and design, taking into account aesthetic, functional and social aspects which should be used in planning new pedestrian streets and improving existing ones.

Methodology

The literature and pedestrian streets of several European cities were explored in the framework of the study. The pedestrian Strøget street in Copenhagen (Denmark), pedestrian zones in Ghent (Belgium) and Zutphen (the Netherlands) as well as Vilnius street in Kaunas have been chosen as examples from foreign countries for the analysis. The above mentioned pedestrian streets and areas have successfully addressed issues related to environmental accessibility, functionality and aesthetic design, they have been successfully integrated into the urban environment and are widely used. Furthermore, Joma street in Jūrmalā, Brīvības street in Ogre un Rīga street in Daugavpils, notable examples from Latvia, were analyzed in Latvia. Over time these pedestrian streets have gained iconic significance in urban and national contexts, they are functional, pedestrian-friendly and attractive.

Based on the literature review on pedestrian street planning and quality, criteria were worked out to assess the aesthetic quality, functionality, comfort level, facilities and necessary improvements for the purpose of evaluating and comparing pedestrian streets. Table 1 shows the criteria according to which three selected pedestrian streets in Latvia were evaluated and which could serve as recommendations for the pedestrian street plan and general infrastructure design to create a safe, comfortable and pleasant space with a beautiful landscape for pedestrians in the urban environment (Table 1).

TABLE 1

Quality criteria for evaluation of a pedestrian street
[the scheme was made by the authors]

Name of a pedestrian street, city, country		
Parameters	Length of pedestrian street	
	Width of street	
	Average building height	
Restrictions	Motorised traffic	Completely closed
		Permitted at certain times of the day and night
	Cycling	Permitted
		Forbidden
Outdoor elements	Surface	
	Benches	
	Waste bins	Bins for dog excrements
		Waste sorting bins
		Small waste bins
	Lighting	Tall street light poles
		Average height street lights
		Street lights are installed in surfaces
		Illuminated facades
	Bike parking racks	
	Game elements	
Greenery	Trees	Deciduous trees
		Coniferous trees
	Fencing greenery	
	Flower box street furniture	
	Inclusion in the city's green infrastructure network	
Sustainability and ecology	Management of rain water	Central storm drain grid
		Rain garden
	Materials used	

CONTINUATION TABLE 1

Name of a pedestrian street, city, country,	
Integration in urban environment	Connection to city node points
	Traffic comfort
Environmental accessibility	Central lines, tactile cover
	Slopes, ramps
Landmarks	Art objects
	Informations stands
	Sign Posts
	Water elements, fountains
Street's spatial structure, architectural compositional solutions	Vertical dominants
	Squares integrated into the street infrastructure
Other typical elements	

Results and Discussion

The most intense pedestrian flows are found in city centres, therefore pedestrian street planning is expected to happen in the central part of the city. When spatial structure of a street is planned, it is necessary to embed its existing architectural plan in the general laws of composition. The main and the subordinate details have to be linked in a compositional unit, therefore the same scale, proportions and contrasts, rhythm, asymmetry and symmetry have to be observed [3]. The pedestrian street infrastructure must be included in an overall compositional solution of the city (Fig. 4)

All three analysed pedestrian streets are located in the central parts of cities, successfully connected with significant traffic, cultural, educational, etc. node points. They are strategically planned, multifunctional, comfortable and safe, designed to match the city's overall compositional image and identity, which is in line with J.Briņķis and O.Buka city planning theory [3]. According to Wertheimer et al. [20], the streets have functional amenities - seating surfaces, hard surfaces for easy movement. The analysed pedestrian streets of Latvia are conveniently connected to other objects important for the residents of the city, for example, *Joma* street in Jūrmala city leads to an important cultute centre – Dzintari Concert Hall; then in the city of Ogre, *Brīvība* street is directly linked with Ogre railway station and Ogre municipality culture centre (Table 2), as regards the city of Daugavpils, *Rīga* street connects Daugavpils railway station with the city centre.

The pavement of pedestrian streets in Ogre and Daugavpils is designed to divide the street infrastructure into functional zones. In addition, the pavement creates a visually attractive view that enlivens the overall image of the street, seemingly shortening the distance to be covered. The advantages of pavement's patterns are less used in the pedestrian street in Jūrmala. The analysed pedestrian streets of Latvia include such elements as flower pots, stands and enclosing poles, which protect pedestrian areas from unauthorized entry by cars; there are decorative water elements and greenery which create a relaxing impression and perform a cooling function in hot weather conditions; lighting suitable for pedestrians illuminates the streets during the dark hours and creates a sense of safety; there is also decorative lighting that highlights architectural elements. Additionally, pockets and small squares are integrated into straight sections of *Joma* street and *Brīvība* street, where pedestrians can meet and relax (Fig. 3).

Planning the city's public space and its green areas requires specialists to focus primarily on the street landscape, not just parks and squares, because the street landscape directly affects the daily life of the city, when pedestrians move through the streets in their daily lives, when they are not home, work or leisure [9]. It is important to ensure the public function of the city so that the city's outdoor space becomes a meeting place that promotes social sustainability [10].

According to the opinion of J. Gēls on the role of street landscape in the urban environment [10], *Joma* street in Jūrmala is a good example of how a pedestrian street performs the main function of a public outdoor space in a city. *Joma* street complies with the principles of pedestrian infrastructure planning, it is convenient for users and over time has acquired the status of a positive image representing the city of Jūrmala. The pedestrian street in Jūrmala has some shortcomings related to trends and construction principles during the street renovation works, for example, the use of standard concrete paving which does not highlight the individual features and identity of the area; rain gardens and green areas are at the same level as the street surface; waste sorting bins and bins for dog excrement. It is necessary to increase the number of bicycle parking racks in *Joma* street taking into account the fact that it is forbidden to ride bicycles on the street, but the area of Jūrmala cycling route network is in short distance from the pedestrian street. In many parts of Europe mixed types of traffic is practiced in residential areas and pedestrian zones, however, a significant precondition is the priority given to an pedestrian otherwise traffic participants should be separated [10]. Bicycle parking racks are an important street element not only in the conditions when cycling is forbidden in the pedestrian street, but also in the conditions when it is allowed because racks are necessary to maintain comfortable and dynamic movement around the urban environment.

According to the theories of J. Briņķis, O. Buka [3] on the importance of greenery in the improvement of aesthetic appearance of the urban environment, maintenance and improvement of its ecological and climatic conditions, as well as in the organization of recreation, *Joma* street greenery is

appropriate and functional in the urban context. The evaluation of seasonal greenery in the area of *Joma* street leads to a conclusion that there is a lack of decorative greenery that would maintain its splendour also in the cold months of the year, for example, small ornamental shrubs and perennials that keep their decorative function for a long time. A positive image in the greenery infrastructure of *Jomas* street is created by coniferous trees which look attractive also in the cold season and which are characteristic of the natural vegetation of the territory of Jūrmala city.

The pedestrian street in Ogre is functional, visually attractive and user-friendly. The entire length of the street is designed to allow a variety of uses: the city square with a stage for events, loungers and areas with benches for relaxation, a square with swings for children, greenery and art objects for aesthetic enjoyment, enough free space for outdoor commercial stands during city festivals.

Similar principles apply both to the planning of pedestrian streets and to the planning and reconstruction of residential quarters, since it is necessary to preserve historically valuable street planning and cultural and historical landscapes [3]. Accordingly, historic building elements play a significant role in *Brīvības* street.

Public toilets are also located in *Brīvības* street. During the dark hours, the street is illuminated with street lamps placed at regular distances at different heights, as well as the lighting is complemented by decorative lighting of architectural elements of buildings. The greenery infrastructure in the pedestrian street is functional, well-kept, decorative and visually matching.

The design of pedestrian areas requires to understand the physical dimensions of the human body and the nature of movement in different conditions [20]. The main shortcoming in the pedestrian street infrastructure, which is not in line with the generally accepted basic principles of user-friendly planning, is the underground pedestrian walkway connecting *Brīvības* street with Ogre railway station. It is inconvenient for pedestrians to move through the walkway, and there is limited access to the environment.

When planning pedestrian streets, it is important to provide a connection with public centres, schools, parks, transport destinations and other urban nodes in order to ensure a continuous flow of pedestrians [5]. Boulevards and pedestrian streets can be traced in the direction of the pedestrian flow, providing convenient connections to workplaces, public transport stops, public and shopping centres, residential gardens, sports complexes, etc. [3]. *Rīgas* street in Daugavpils is functional, easily accessible, located in connection with important objects for the city's residents. The street infrastructure is partly included in the city's green infrastructure network due to small squares that are connected to the street infrastructure, however, wider green areas are not connected to the pedestrian street.

Relaxation places, waste bins as well as bicycle parking racks are located along the entire length of the pedestrian street. Decorative and interactive environmental objects, water elements are located in some sections. The missing elements include outdoor objects such as waste bins for dog excrements and waste sorting bins.

Some new chestnut trees have been planted in the green areas of the street, however, there is a lack of ornamental herbaceous plants, shrubs and flower beds. Decorative flower beds can be found only at the beginning of the street in the square next to Daugavpils St. Peter's Church.

The disadvantages include the lack of a sustainable rainwater management system and rain gardens in *Rīga* street.

Unobstructed movement requires free space to keep pace, perceive the surroundings and react to others. The pedestrian street must be attractive and well-maintained, however, there must be no obtrusive objects in the way of pedestrian paths, i.e., signs, advertisements, greenery, and other objects which should be avoided.

The capacity of footpaths depends on their quality and the speed of the pedestrian flow. The distance and speed are the main limiting factors for pedestrian zones. A person is ready to cover distances not more than 800 m of length in their daily routine on average [20]. Due to the fact that an average pedestrian speed is 5 km / h, the distance is covered in about 12 minutes. If the distance is longer than 800 m, a pedestrian will prefer the motorised transport. The analysed streets are designed to be comfortable for the residents and to fulfill their main functions, i.e., to provide a pleasant public outdoor space and to create a link in which to move between important nodes of the city to compare with the findings of Wertheimer et al. [20] on the length of a pedestrian's distance.

Recommendations and Conclusions

The environment and pedestrian streets in cities must be designed to encourage people to walk on a daily basis. The plan should encourage people to look for work close to home, use the services around them and become part of the local community. Together, these factors would reduce the use of private cars.

Prior to the planning of a pedestrian street in the city, it is necessary to define the meaning of the pedestrian street in the context of the city and the need for it. When designing a pedestrian street, it is important to take into account the basic principles, which should be followed to create a functional

pedestrian street. Recommendations and conclusions based on the literature review and the evaluation of pedestrian streets in European and Latvian cities are given below.

Connectivity: a network of pedestrian zones connecting all major nodes in the city between which pedestrians have to move. It is necessary to ensure the satisfaction of people's basic needs in a pedestrian street: the need for fresh air, water, recreational opportunities, as well as public toilets should be available. The access to public transport is important and it must be possible to move within the city's green infrastructure network.

Convenience: primary routes should be direct, but awkward solutions and obstacles should be avoided. Road crossings must be easy without long waiting time, pedestrian crossings should be clearly defined and safe.

Comfort: pedestrian streets and areas must be of appropriate width. Appropriate materials should be used in their planning, which ensure comfortable movement; steep slopes, slipping risk should be avoided. Pedestrian paths should be positioned in such a way that it is possible to move safely. The amenities of the pedestrian street must be designed in accordance with the climatic conditions of the area.

Ethic conditions: a footpath must be illuminated during the dark hours, it should be suitable for communication among people without unnecessary noise and air pollution. The overall image of a pedestrian street should be visually attractive, in accordance with the city's identity with respect to the cultural and historical heritage.

Clarity: pedestrian routes should be easy to understand with clear signs, images, pavement markings, landmarks and sign posts. Prior to planning pedestrian streets, it is important to make the right strategic decisions regarding the use of open spaces. The location of landmarks, the strategic planning of squares and "pockets" encourage the use of infrastructure. The design of open spaces and greenery are crucial factors in maintaining an appropriate climate in the area; potential climatic conditions in the given area should be taken into account when planning the activities to be carried out [13].

Inclusion of a pedestrian street in the city's green infrastructure network: an open green space is planned in relation to the surrounding buildings. It is important to strengthen the green network in the city in order to improve the climate, biodiversity, water absorption, general comfort and recreational opportunities [13].

Pedestrian streets should be planned as part of the urban public space turning them into a good quality and multifunctional outdoor space. Thus it is possible to improve the overall image of the city by creating diverse landscapes, to promote pedestrian mobility and mental health by facilitating a city's economic growth and the quality of the environment.

It is of crucial importance now to improve urban infrastructure and public space, to make it pleasant for residents and improve the quality of life and the environment in the city.

Purposeful and strategic planning of pedestrian streets provides an opportunity to expand public space in the city, makes walking interesting, comfortable and safe. Clearly defined and well-maintained pedestrian streets in the city are a place to move, meet, relax and do shopping.

The design of green infrastructure in the pedestrian street may be included as a component in the city's green infrastructure network, in which greenery performs aesthetic and climate improvement functions. Green areas at the level of the pavement solve problems related to rainwater management. Pedestrian streets ensure divide pedestrians from car traffic, improve the quality of life in the city center; in addition, an aesthetically attractive pedestrian street has a positive image in the eyes of tourists.

The planning of traffic infrastructure in the urban environment is a long-term process that requires research and adaptation of the situation to changes, therefore it is necessary to include the intended conversion of pedestrian streets in the long-term urban development plans.

In the future there is a need for a more thorough evaluation of pedestrian infrastructure, in particular, pedestrian-oriented legislation and planning strategies to identify the necessary changes. When providing recommendations for the pedestrian street planning in urban planning documents, it is necessary to clearly define the conditions according to which pedestrian streets have to function in urban environment to create a balance between pedestrians and motorised vehicles in urban traffic.

There is a need to encourage people to walk on a daily basis, inform them of potential benefits for both health and improvement of the urban environment. Attractive public space where the use of motorised vehicles is prohibited could change the opinion that the dominant transport in urban areas is a car.

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Kopsavilkums. Ilgtspējīgas, funkcionālas, patīkamas un stratēģiski plānotas pilsētas raksturojošās iezīmes ir tās piemērotība kājāmgājēju satiksmei, kā arī sakārtota pilsētvide kopumā. Stratēģiski plānojot gājēju ielas, iespējams atdzīvināt pilsētu centrus, veidojot ainavisku un funkcionālu publisko ārtelpu. Pētījums apskata gājēju kustības nozīmi pilsētvidē, gājēju ielu struktūras un ainavtelpu plānošanas principus pilsētvidē. Ir izpētītas un analizētas vairākas gājēju ielas pasaulē un Latvijā. Pētījuma ietvaros izstrādāta gājēju ielas kvalitātes kritēriju novērtēšanas metode, kurā iekļauti kvalitātes kritēriji, kas veido gājēju ielu par kvalitatīvu, ērti lietojamu publisko telpu, kas izmantojama ne tikai pārvietošanās nolūkos, bet arī kā daudzfunkcionāla vieta dažādām aktivitātēm – atpūtai, tirdzniecībai, komunikācijai u.tml.

Noslēgumā sniegti ieteikumi gājēju ielu telpiskās struktūras un ainavtelpu veidošanai pilsētvidē, uzsverot nepieciešamību gājēju ielas aprīkot ar kvalitatīviem un ilgtspējīgiem ārtelpas elementiem, nodrošināt vides pieejamību, kā arī iekļaut gājēju ielu pilsētas kopējā zaļās infrastruktūras tīklā, pamatojot to gan no sociālajiem, gan vides aspektiem.