



LANDSCAPE ARCHITECTURE AND ART

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INTRODUCTION

The 18th edition of our collection of scientific articles represents a unique symbol of 'full age' for the collection of scientific research projects by the Latvia University of Life Sciences and Technologies related to the study of architectural landscape space in urban environment, cultural landscape and rural landscape space.

The rapid transformation process of the early 21st century in each of the above-mentioned cultural spaces not only brings a new scale and silhouette, but also draws increasing attention to the search for synthesis, harmony and balance in environmental functionality, ecology and historical identity.

A vivid proof for the above-mentioned facts is provided by a study of modernist tendencies in the development of the Nordic urban environment – the design of green structures, the language of architectural design of buildings and innovative application of construction technologies. This is especially applicable to the recent research projects on biophilic architecture, which addresses in more detail the problem of building facade analysis methodology based on interdisciplinary nature, involving static calculations of engineering science. In its turn, the research of Lithuanian architects perfectly defines the peculiarities of the perception of urban space – history, culture, political situation, geomorphology, as well as evaluates the education, aesthetic and cultural sophistication of an individual or observer.

The research projects published also touch on the rapid growth of the world's cities, which led to significant changes in the processes of urban sprawl, land distribution and functioning patterns. Problems related to ecology, economy, people's physical and mental well-being are growing due to the lack of open green spaces, food security and sustainable financial models for small businesses. That is why the popularity of 'urban agriculture' or urban horticulture increase. This give architects a new trend of research in urban planning. This is especially relevant for the interdisciplinary interdependence of our University scientists, giving another obvious evidence for the **uniqueness of the study programmes of the Latvia University of Life Sciences and Technologies.**

The above-mentioned studies are related to the transformation of the cultural and historical landscape of a certain territory. One of the articles examines the wave of prosperity of the manors in the former Duchy of Courland in the beginning of the 18th century. In its turn, the political and economic pulsation in a 300-year period has brought about a serious fragmentation of the historical cultural landscape and a functional change of territories.

PRIEKŠVārds

Mūsu zinātnisko rakstu krājuma 18. izdevums savdabīgi simbolizē "pilngadību" Latvijas Lauksaimniecības universitātes zinātnisko pētījumu apkopojumam, kas saistās ar arhitektoniski ainaviskās telpas izpēti pilsētvidei, kultūrainavai un lauku ainavtelpai.

Straujais 21. gs. sākuma posma transformācijas process katrā no iepriekš minētajām kultūrtelpām, ienes ne tikai jaunu mērogu un siluetu, bet aizvien intensīvāk vērš uzmanību uz sintēzes, harmonijas un sabalansētības meklējumiem vides funkcionalitātē, ekoloģijā un vēsturiskajā identitātē.

Minēto spilgti pierāda pētījums par modernisma tendencēm Ziemeļvalstu pilsētvides attīstībā – zaļās struktūras dizains, ēku arhitektoniskās formveides valoda un būvniecības tehnoloģiju avangarda pielietojums. Īpaši tas ir attiecināms uz jaunākajiem pētījumiem par biofilo arhitektūru, sīkāk risinot problemātiku par ēku fasāžu analīzes metodiku, kas ir balstīta starpdisciplinārā raksturā, piesaistot inženierzinātnes statistiskos aprēķinus. Savukārt, Lietuvas arhitektu pētījumi perfekti definē pilsētelpas uztveres īpatnības – vēsturi, kultūru, politisko situāciju, ģeomorfoloģiju, kā arī ievērtējot indivīda jeb novērotāja izglītību, estētisko un kultūras izsmalcinātību.

Publicētie pētījumi skar arī pasaules pilsētu straujo izaugsmi, kas ir novedis pie būtiskām izmaiņām pilsētu izplešanās procesos, zemes sadalījumā un funkcionēšanas modeļi. Pieaug problēmas, kas saistītas ar ekoloģiju, ekonomiku, cilvēku fizisko un garīgo labklājību, jo rodas atvērtu zaļo zonu trūkums, uztura drošība un ilgtspējīgi finanšu modeļi mazajiem uzņēmējiem. Tāpēc aizvien populārāka kļūst "pilsētu lauksaimniecība" jeb urbānā dārzkopība. Arhitektiem tas dod jaunu pētniecisko virzienu pilsētplānošanā. Īpaši tas ir aktuāli mūsu Univeristātes zinātnieku starpdisciplinārai sazebei, kas vēlreiz skaidri pierāda **Latvijas Lauksaimniecības Universitātes studiju programmu unikalitāti.**

Iepriekš minētie pētījumi ir saistāmi ar noteiktas teritorijas kultūrvēsturiskās ainavtelpas transformāciju. Viens no rakstiem aplūko 18. gs. sāk. bij. Kurzemes hercogistes muižu uzplaukuma vilni. Savukārt, politiski ekonomiskā pulsācija 300 gados ir ienesusi nopietnu vēsturiskās kultūrainavas sadrumstalotību un teritoriju funkcionālo maiņu.

Vairāki pētījumi akcentē Eiropas un austrumu kultūru savstarpējo mijiedarbību. Viena no tām – t.s. ķīniešu parka paviljonu formveides izmantošana. Dziļāk ir aplūkots ķīniešu arhitektūras tradīciju kontekstuālisms Rietumvalstu arhitekūrā

A number of studies emphasize the interaction between the European and Eastern cultures. One of it is the use of the so-called Chinese park pavilion design. A closer look is given at the contextualism of Chinese architectural traditions in Western architecture from the 60s of the 20th century, as well as stylistic tendencies in European landscape gardens from the beginning of the 18th century. The use of Chinese pavilions, which are characterized by visually high expressiveness, brought a strong compositional accent to the history of European gardens, creating a spatially saturated, interesting and variable expression of the landscape.

A vivid study of the anthropogenic load between the Daugava and Gauja river mouths examines the accumulation and intensification of sand dunes, which in the long run can lead to a decrease in the maximum height of primary dunes and the width of the beach. The data were obtained by performing technical levelling on the shore. The installation of dune fences is a part of coastal management, solving the problem of the preservation of the coastal landscape.

Finally, as opposed to the previous research projects, architects are looking for solutions to the current catastrophic pandemic situation in the world. To obtain a vision for the development of fixed facilities, the proposals for a functional solution of green areas designed by Spanish architects are considered.

no 20. gs. 60. g., kā arī stilistikas tendences Eiropas ainavu dārzos no 18. gs. sāk. Izmantojot Ķīnas paviljonus, kas raksturojami ar vizuāli augstu izteiksmīgumu, Eiropas dārzu vēsturē ienesa kompozicionāli spēcīgu akcentu, veidojot telpiski piesātinātu, interesantu un mainīgu ainavtelpas izteiksmi.

Spilgts pētījums par antropogēno slodzi starp Daugavas un Gaujas grīvām – ir smilšu kāpu uzkrāšanās un pastiprināšanās, kas ilgtermiņā var izraisīt primāro kāpu maksimālā augstuma un pludmales platuma samazināšanos. Dati iegūti, veicot tehnisko nivelēšanu krastam. Kāpu žogu ierīkošana ir piekrastes apsaimniekošanas izmantošana, risinot piekrastes ainavas saglabāšanu.

Visbeidzot, kā pretmets iepriekšējiem pētījumiem ir arhitektu meklējumi patreizējās katastrofālās pandēmijas situācijas risinājumiem pasaulē. Lai iegūtu stacionāro iestāžu attīstības vīziju, tiek aplūkots Spānijas arhitektu projektēto zaļo teritoriju funkcionālā risinājuma priekšlikumi.

Aija Ziemeļniece
Editor in Chief

CONTENTS

Una Īle

Visual-spatial dimensions of modern residential buildings, experience of the Nordic region7

DOI: 10.22616/j.landarchart.2021.18.01

Marius Ivaškevičius, Huriye Armağan Doğan

Computational Analysis of Biophilic Scale Distributions of Façades in Kaunas City Centre16

DOI: 10.22616/j.landarchart.2021.18.02

Vaida Vaitkutė Eidimtienė, Jūratė Kamičaitytė

Perception of Cityscape of the Central Part
of Kaunas and Sociocultural Aspects Determining it29

DOI: 10.22616/j.landarchart.2021.18.03

Cristina Jorge

Landscape intervention in the Hospital for Covid-19 pandemic in Madrid39

DOI: 10.22616/j.landarchart.2021.18.04

Dorofeieva Kateryna, Kristīne Vugule

Phenomenon of Urban Agriculture and Its Role in Shaping Sustainable Cities49

DOI: 10.22616/j.landarchart.2021.18.05

Maria Żychowska, Yulia Ivashko, Peng Chang,

Andrii Dmytrenko, Nataliia Kulichenko, Xin Mu Zhang

The influence of traditional Chinese landscape architecture on the image
of small architectural forms in Europe59

DOI: 10.22616/j.landarchart.2021.18.06

Lelde Bāra, Aija Ziemeļniece

Causes and consequences of cultural and historical manor landscape fragmentation
in the 19th - 21st century Latvia69

DOI: 10.22616/j.landarchart.2021.18.07

Albert Fekete, Peter Gyori

Chinese pavilions in the early landscape gardens of Europe78

DOI: 10.22616/j.landarchart.2021.18.08

Jānis Lapinskis

Geomorphing effect of sand fences in primary dunes of Gulf of Riga88

DOI: 10.22616/j.landarchart.2021.18.09

Yulia Ivashko, Peng Chang, Polina Zueva, Yang Ding, Tetiana Kuzmenko

Continuity of traditions and innovation in modern landscape design in China94

DOI: 10.22616/j.landarchart.2021.18.10

Ansam Bzour, István Valánszki

A study of developing a spatial entity greenway in the case of Irbid City – Jordan 104

DOI: 10.22616/j.landarchart.2021.18.11

Visual-spatial dimensions of modern residential buildings, experience of the Nordic region

Una Īle

Latvia University of Life Sciences and Technologies, Latvia

Abstract. The visual-spatial dimensions of architecture are constantly changing, architects and urban planners are aware and understand the need for a healthy, active, vibrant public outdoor space, creating viable, economically and rationally suitable living spaces in the urban environment [12]. A comprehensive approach to sustainable architecture and design with a green structure combines a high-quality urban environment. In modern architecture, one of the perspective directions in the development of visual-spatial environment and structural forms is related to the active and continuous synthesis of the design and construction process in the urban environment [13; 4]. In recent years, the tendencies of rationalism and commercial nature based on technological progress have entered architecture and create a need for the architects to purposefully cooperate with the urban planners in the elaboration of development plans. The format of mutual cooperation brings together and rationally balances various dimensions of the urban environment in a compact visual-spatial structure. Thus, the aim of the research is to determine the visual-spatial dimensions of modern residential buildings in the context of sustainable urban development.

Keywords: visual-spatial dimensions, modern residential buildings, multifunctional outdoor space

Introduction

Along with compact visual-spatial structure, one of the tasks of synthesis in architecture is to create a spatially substantive architecture that increases emotional potential by assessing the psychological perception of a person as a user of a living space. The visual-spatial solutions and dimensions of architecture are different – one part was formed according to a certain plan developed for a building complex with a certain architectural idea, while other parts are forming over a larger period of time, gradually developing on the basis of unified composition ideas [13]. Regardless of the scale, balanced and sustainable socio-economic and urban context, the architects ultimately focused on the visual image of the area to be designed and developed. Recent approaches to urban planning promote a variety of development concepts based on the principle that the urban environment functions as a living organism with complex metabolism [17; 4]. Thus, the visual-spatial dimensions of architecture determine the organization of the living space, reflecting the rational planning and interrelationships of functional zones. To form a single spatial form, the spatial structure must ensure the interaction of all functional areas.

Materials and Methods

The informational and theoretical basis consists of an analytical overview of modern residential buildings and their visual-spatial dimensions. To achieve the goal of the research, scientific research sources, publications and monograph

materials have been used. To perform the tasks of the research, two scientific research methods have been used: comparative analysis – to study the experience and approaches of the Nordic region in terms of modern residential construction; cartographic method – the research and development of visual graphic materials for the examples of areas analysed and surveyed in the study of Denmark, Norway and Sweden. All images and diagrams used in the study, which do not include references to the sources, are visually developed and created by the author in the process of the study. The research and evaluation of the territories defined in the research has been performed on the basis of scientific research materials, as well as the survey of the territories in nature, performing photo fixations in all the territories included in the research in the period of 2017–2020.

Results and Discussion

Along with compact visual-spatial structure, one of the tasks of synthesis in architecture is to create a spatially substantive architecture that increases emotional potential by assessing the psychological perception of a person as a user of a living space. The visual-spatial solutions and dimensions of architecture are different – one part was formed according to a certain plan developed for a building complex with a certain architectural idea, while other parts are forming over a larger period of time, gradually developing on the basis of unified composition ideas [4]. Regardless of the scale,

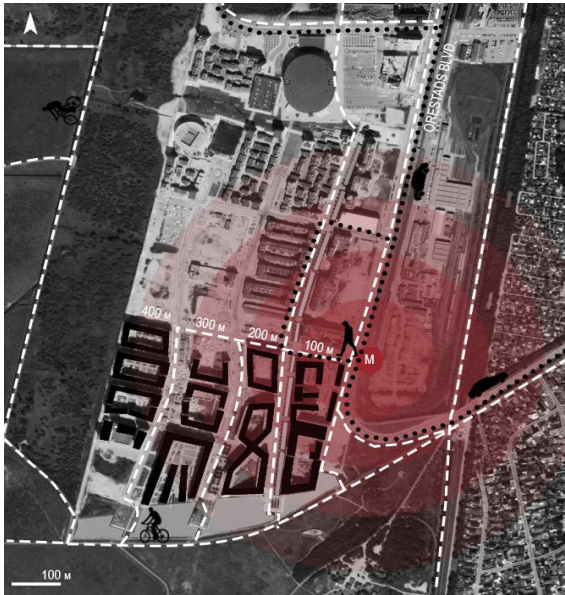


Fig. 1. Ørestad area in the south of Denmark
[created by the author, 2021]



Fig. 2. 8 TALLET [photo Una Īle, 2018]

balanced and sustainable socio-economic and urban context, the architects ultimately focused on the visual image of the area to be designed and developed. Recent approaches to urban planning promote a variety of development concepts based on the principle that the urban environment functions as a living organism with complex metabolism. Thus, the visual-spatial dimensions of architecture determine the organization of the living space, reflecting the rational planning and interrelationships of functional zones. Therefore, one of the examples of good practice is the Ørestad area in the south of Denmark surveyed in the study (Fig. 1), which is a 7-minute journey by metro from Copenhagen and a 30-minute drive from Malmö. The territory, which is linked to the Copenhagen metro, is being developed according to the currently widespread concept of a compact city [5; 16].

The territory of Ørestad was developed by the *Port & City Development Corporation*. The corporation is owned by the city of Copenhagen (51%) and the Danish state (45%). *Port & City Development Corporation*, which is providing port management and urban development, was founded in October 2007. The former Ørestad Corporation

was established in 1993, when the Danish state set up a new corporation to develop and sell land and to build a metro in Copenhagen, which was connected with high construction costs of the metro [10]. The area of Ørestad under study had about 100 inhabitants in 2004, but along with the development of the area, the population increased to 7,500 already in 2012, and the Ørestad area generally aims to have a population of up to 20,000, with the possibility of employment for 80,000 people. Based on the elaborated development concept, the territory of Ørestad is divided into four zones: *Ørestad Nord*, *Amager Faelled*, *Ørestad City* and *Ørestad Syd* [11]. The Ørestad area consists of many residential and commercial buildings, with their own character and symbolic features of the place, located along the main axis of the composition that follows the metro station. Under the metro and between the buildings, there is a multifunctional public outdoor space developed, so that people can feel free and do what they want. The basic construction scheme is based on a metro one-level solution and is connected with a comfortable environment surrounding by mixed-type buildings. Although the distances between the buildings may seem to be private outdoor areas, they are conceptually designed as open public outdoor areas for walking, which ensures the free flow of people throughout the territory. The visual and spatial dimensions of architecture in the Ørestad area are different, the architects have played with different facade solutions, various building shapes and proportions. One of the most expressive visual-spatial forms and solutions in the Ørestad area is 8 House or 8 TALLET in Danish. 8 House is a mixed-type residential building with the area 61,000 m² consisting of various types of living space solutions, but 10,000 m² – of retail space and offices (Fig. 2).

In 2011, 8 House won the award as a flagship project in the residential building category at the World Architecture Festival, where the jury highly evaluated a non-traditional architect's solution of combining retail, rowhouses and apartments in one building with elevated 1st floor street levels, providing new access levels in socialization matters. In terms of multifunctionality, 8 House also provides a function of a kindergarten, located on the 1st floor level and consisting of a large closed area for kindergarten children, providing a convenient connection to the living area, equally eliminating traffic jams for transporting children to kindergarten. The Scandinavian green roof association has nominated 8 House as the best green roof in the Scandinavian countries. BIG architects have demonstrated a very clear and conscious use of the green roof, rationally integrating it into the visual identity of the building. 8 House is a 1,700 m² sloping roof of moss and succulents, covering the roof surface from the 11th floor to the edge of the water canal [3].

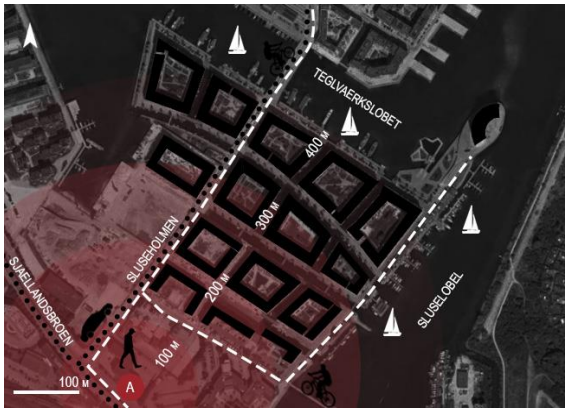


Fig. 3. Sluseholmen area [created by the author, 2021]



Fig. 4. Sluseholmen canal infrastructure [photo Una Īle, 2018]

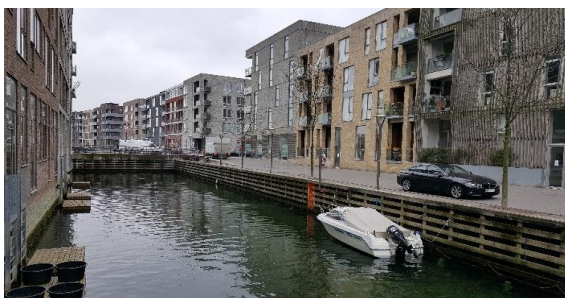


Fig. 5. Sluseholmen canal infrastructure [photo Una Īle, 2018]



Fig. 6. Sluseholmen residential buildings [photo Una Īle, 2018]



Fig. 7. Sluseholmen courtyard area [photo Una Īle, 2018]

It is strategically located to reduce the greenhouse effect in the urban environment and visually comprehended as an integral visual accent in the *Ørestad Syd* area. The green road with its sloping shape and roof terraces creates an attractive and mutually coordinated visual and spatial image. A wide panorama of the surrounding area opens from the terrace and form a visual connection with the existing green structure outside the design area. The rest of the newly erected buildings in the territory of *Ørestad Syd* are forming a different visual-spatial residential building with different facade solutions. Designers have used different approaches in spatial solutions, emphasizing both building shapes, proportions through qualitatively designed small architectural forms and details in facades. In general, the mutual location of the construction volume of each residential building has been assessed and carefully considered, creating an easily comprehensible, easily usable urban structure [9; 3].

In the southern port area of Copenhagen, along the *Sluseholmen Canal* (Danish: *Sluseholmen Kanalby*), the construction of a residential building (135,000 m²) on the *Sluseholmen Peninsula* was completed in 2008 (Fig. 3, 4, 5). The general concept of the area was developed by the architect Sjoerd Soeters and *Arkitema Architects* office, inspired by the artificial island building in Amsterdam. *Sluseholmen* consists of eight inhabited islands with big and small buildings, which architecturally form continuous building blocks [14; 6]. The residential buildings are created in close connection with canals, while bridges, berths and embankments allow residents to access the water. The general plan of the territory and the concept of its development were also designed by the architects' office *Arkitema* together with Sjoerd Soeters. For the *Sluseholmen* area, the authors developed certain architectonic spatial structures, general spatial planning rules, defining the use of specific proportions and dimensions, materials and colours. The area includes 1,350 apartments designed on all eight artificial islands and separated by excavated canals (Fig. 6, 7).

To provide a diverse urban landscape, which has been inspired by Copenhagen architecture already since 1900, public authorities have decided that at least five different designers must be involved in the design of each island. Thus, guided by the defined approach, a cheerful, imaginative set of blocks with mutual visual-spatial differences and accents was achieved in the result.

The analyzed area of *Aker Brygge* (Fig. 8), located to the west of the centre of Oslo, Norway, on the Pipervik fjord embankment, undergo several decades of the visual-spatial change of architecture. Before that, *Aker Brygge* was an industrial site for *Akers Mekaniske Verksted AS* shipbuilding yard, which ceased its

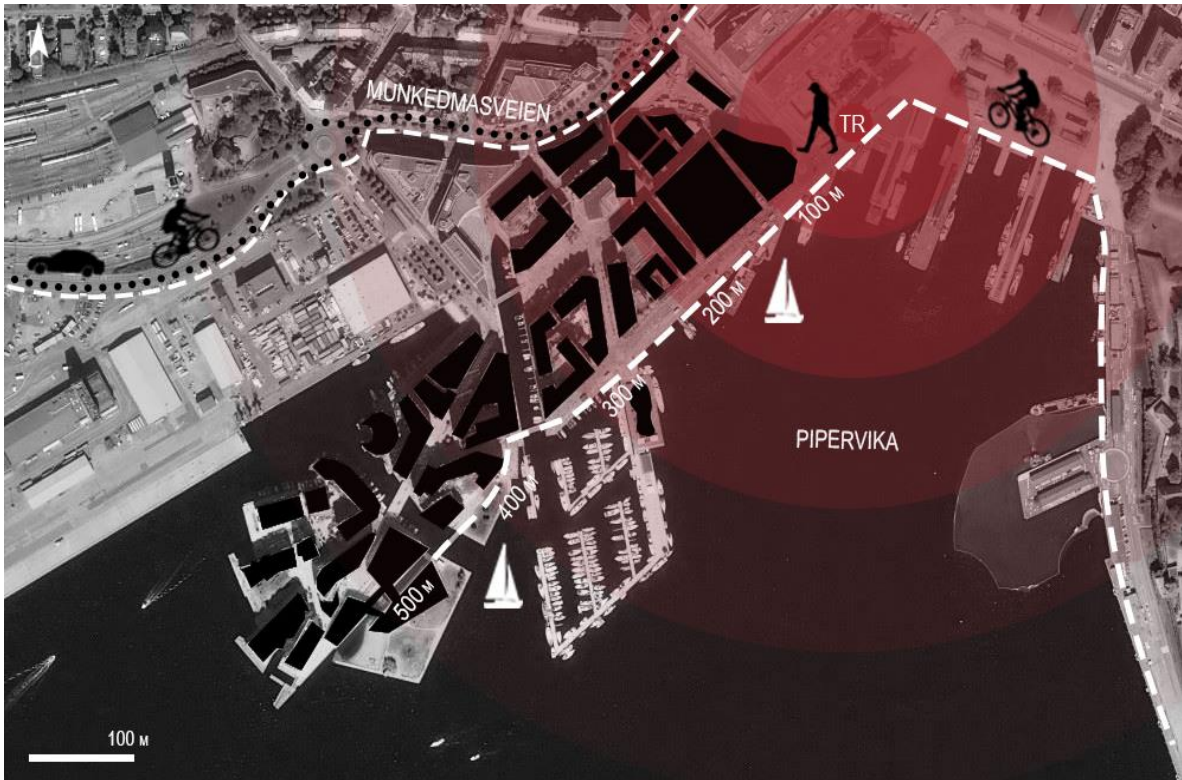


Fig. 8. Aker Brygge, Oslo, Norway [created by the author, 2021]



Fig. 9. Urban places in Aker Brygge [photo Una Īle, 2019]



Fig. 10. Shopping centre area in Aker Brygge
[photo Una Īle, 2019]

operations in 1982. Since 1980-1990, the *Aker Brygge* area has been a popular shopping, dining and entertainment area with a top-class residential area that connected Oslo to the forgotten waterfront [1; 2]. Meanwhile in 2010, the area began to lose its visual appeal of urban environment as compared to other areas, but after it was revitalized by *Norwegian Property ASA*, 12 million people are visiting the *Akre Brygge* area today (Fig. 9, 10) [2].

Ghilardi + Hellsten Arkitekter and Space Group Arkitekter worked on the *Aker Brygge* site revitalization project (2010–2014). Conceptually, the goal of revitalization of *Aker Brygge* included the restoration of the existing areas, creating a new spatial structure, restoring vitality of the suburban area, preserving the characteristics of the urban environment integrated into the commercial concept. The structure of the external and internal streets in the *Aker Brygge* area was transformed, unifying them into a single system. Prior to the revitalization process, shopping centres were interconnected by bridges that isolated people from the use of the streets, keeping visitors inside the shopping centres. Thus, the designers conceptually created one diagonal shopping street. The diagonal shopping street was planned with the principle of ‘gaps’, creating the structure of side streets, highlighting four different street outdoor spaces, two of them based on a concept of landscape elements, and the other two with urban art spaces.

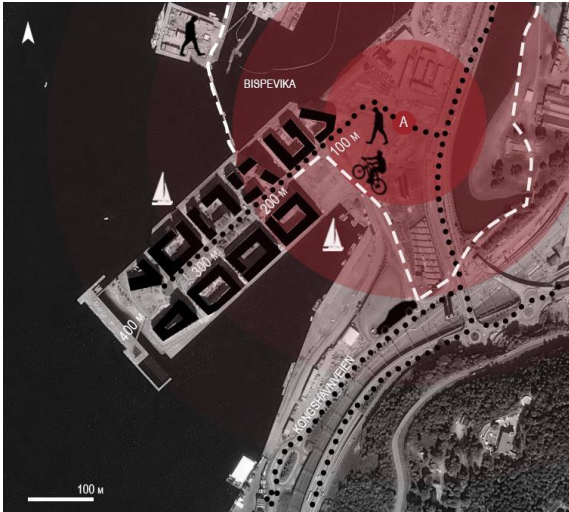


Fig. 11. Sørengautstikkeren, Oslo, Norway
[created by the author, 2021]



Fig. 13. Sørengautstikkeren canal infrastructure
[photo Una Īle, 2019]



Fig. 12. Sørengautstikkeren residential buildings
[photo Una Īle, 2019]



Fig. 14. Sørengautstikkeren outdoor café area
[photo Una Īle, 2019]

The *Aker Brygge* embankment promenade was upgraded with a new elevation of concrete cobblestones to a common level, the designers provided a new lighting system, elements of public outdoor facilities and various environmental objects. The promenade is designed with a functional approach to the water surface. A functional terrace has been created so that people can enjoy the visual and physical connection with the fjord. The largest boats are far from the embankment promenade in terms of location. The marina has been modernized

and made more accessible to the public by adding a new approach and a 15 m wide berth for public events. Nowadays, the revitalized *Aker Brygge* area employs 6,000 people and about 900 people have their homes in the area analysed. The *Aker Brygge* site consists of a total of 13 separate units, 9 of which are divided into 823 owners' units. The owners are linked through a comprehensive employment contract, creating a new area of Oslo that is unique both from national and international perspective. In order to promote cooperation

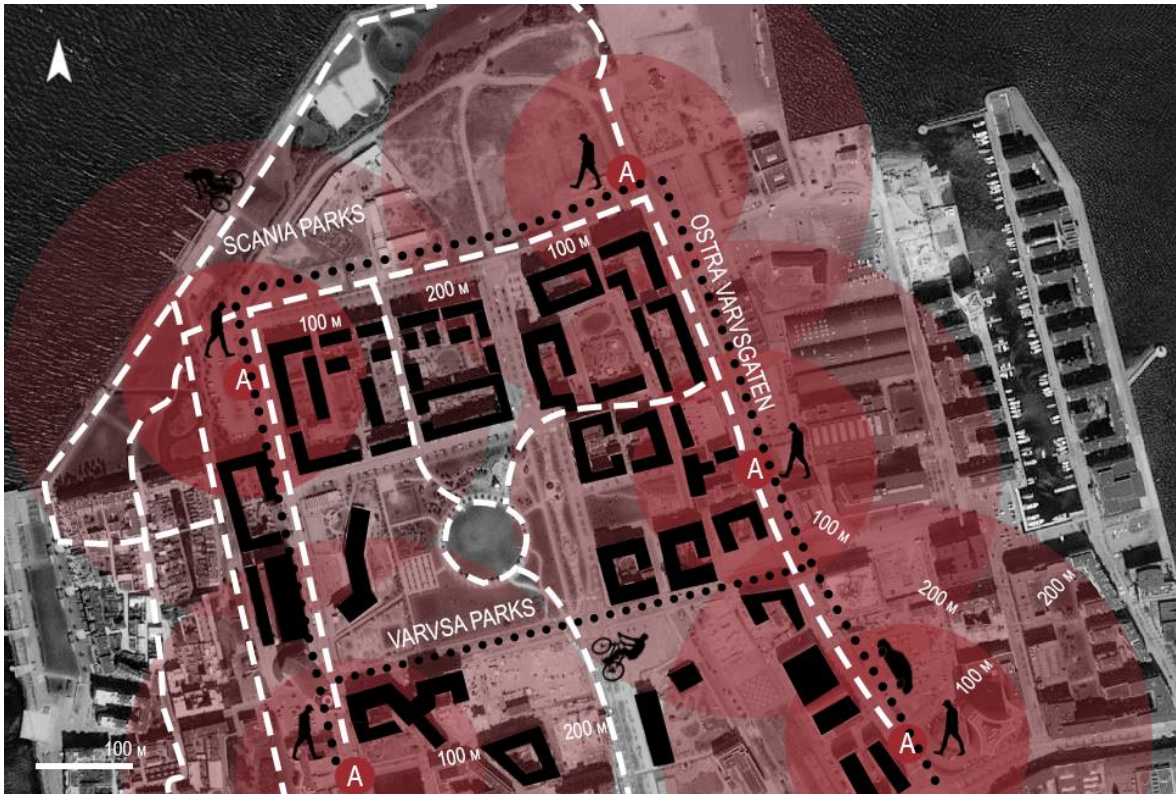


Fig. 15. Västra Hamnen residential area in Malmö [created by the author, 2021]

between apartment owners and the interests of business and culture, several public places for joint events are located in the territory, where the administration of contracts is performed by the joint venture *Bryggedrift AS* [2].

Analysing the visual-spatial dimensions of architecture in *Akre Brygge*, it marks a high-value and high-quality interaction of industrial heritage with modern development trends in architecture. In the *Akre Brygge* areas, where industrial buildings have been preserved, after the revitalization process impact-resistant glass planes have been used in the new building facade solutions to reflect the existence of industrial heritage with modern multifunctional outdoor space, creating an active, vibrant and viable living space for everyone [1; 2]. The visual-spatial dimensions and proportions of architecture in the *Akre Brygge* area are diverse, creating a pleasant and engaging landscape space, saturating it with various accents of green structure and elements of public outdoor space.

Another architectonically expressive residential area equivalent to the *Akre Brygge* area, with a multifunctional outdoor space from the centre of Oslo is *Sørengautstikkeren* (Fig. 11). The artificial peninsula is smaller in scale and proportion than the *Akre Brygge*, but equally rationally and functionally conveniently planned and implemented. Until 2010, the analysed area was a container port, a cruise ship berth and a bulk storage site. The reconstruction of the *Sørengautstikkeren* area was organized by *Sørenga*

Utvikling and the Oslo Port subsidiary *HAV Eiendom*. The development and concept of the spatial plan was elaborated by four architects' offices: *LPO arkitekter*, *Jarmund / Vigsnaes*, *Arkitektelskapet Kari Nissen Brodtkorb* and *MAD*. Each architect's office has developed two blocks, but a common building image has been developed in cooperation with each other. The construction activities were in 2009 and completed in 2012. 950 apartments, commercial spaces, including various shops, were conceptually designed. The cost of the apartments sold is one of the most expensive, as they are in the distance of a walk from Oslo city centre. The *Sørengautstikkeren* territory is conveniently designed in terms of its functionality, using water resources for various recreational opportunities, reducing the flow of motor vehicles, ensuring maximum mobility in the area for walking. The visual-spatial dimensions of architecture correspond to the context of the landscape, creating functional areas of both private, semi-private and public outdoor space. The facades are designed with a decorative brick finish, which is created with individual contrasts of elements and expressive addition of colours (Fig. 12, 13, 14).

A visual contrast to the *Sørengautstikkeren* area with a different approach is represented by *Västra Hamnen* residential area in Malmö (Fig. 15), which has developed in recent years next to the *Bo01* residential area, and in 2001, *Bo01* was the site of a European housing exhibition [15]. The *Bo01* residential area is equally notable for its sustainable



Fig. 16. Västra Hamnen residential area [photo Una Īle, 2018]



Fig. 17. Torso [photo Una Īle, 2018]

development and solutions, as well as it is successfully organized and maintained until nowadays. In general, the adjacent territories near *Bo01* are developing not only with new residential buildings, but also commercial buildings are being integrated into the territory. A number of urban planning principles have been implemented and applied in the *Västra Hamnen* residential area.

The *Västra Hamnen* residential area has attracted international attention by its sustainable development principles and approaches. Each next project in the analysed area continues to grow in the implementation of the principles and approaches of sustainable development in the urban environment. The aim of the *Västra Hamnen* residential area (Fig. 16) is to become an important tool in the development of Malmö as a principle of knowledge transfer in the context of the urban environment. Careful planning is being carried out to make a blend of functions, human activities and ideas, thus proving that there is interaction and active meeting of people outdoors. The residential area of *Västra Hamnen* can be described as a mixed functional area layout, in which buildings, groups of buildings, offices, teas-shops and various leisure activities can coexist in one building volume. One dominant exists in the area – *Torso* (Fig. 17), which is a neo-futuristic residential skyscraper in Malmö and is the tallest skyscraper in the Scandinavian countries. *Torso* belongs to the cooperative association *HSB* and its author is a Spanish architect, civil engineer,

sculptor and painter Santiago Calatrava. The building is 190 meters high with 54 floors and 147 apartments designed, and the skyscraper won the Gold Emporis Skyscraper Award 2005. In the rest of *Västra Hamnen* area, the visual and spatial dimensions of the architecture are proportional to the human scale proportions, reinforcing and providing high saturation with a functionally comfortable and safe multifunctional outdoor space. The architecture of the residential building is diverse, the same as in the *Søregautstikkeren* area, with careful consideration of accents and nuances, but *Västra Hamnen* has taken a different approach to the choice of facade materials, with a wider variety of materials, and, except of *Torso*, the height of the other buildings is lower.

In general, the residential structure of *Västra Hamnen* is simple and concise, creating a balance with a multifunctional outdoor space that integrates the principles of sustainable development; each outdoor area has been carefully planned, highlighting the diversity of natural materials, green structure and safe solutions. Not only semi-private areas on the 1st floor level have been designed and implemented for the residential construction, the architects have also appreciated the solutions of roof gardens with terraces for various activities of residents. The scale of the building in relation to the free, green structure, especially the building adjacent to the park, visually decreases, providing a pleasant overview of the landscape in the residential area.

One of the biggest urban development goals of Malmö is to create a mixed city full of vitality and to become a role model for smart climate change. *Hyllie* area is one of such parts Malmö (Fig. 18). Serious expansion of the southern part of Malmö has been planned since the 1960s, but real solutions and development have only begun with the decision to build a metro station in the *Hyllie* area.

The energy in the *Hyllie* area is produced from renewable or recycled energy sources only, based on so-called smart infrastructure. Due to rapid development, the green surroundings of the area, the location (in the southern part of Sweden) and the functionally convenient travel, *Hyllie* has developed as an attractive area for residents, visitors and entrepreneurs. *Hyllie* Station, the last station in Sweden on the way to Copenhagen Airport and only 12 minutes by train, attracts many residents and merchants thanks to its convenient location. A unique development concept has been developed for the landscape of the *Hyllie* area, which is based on the properties of the green structure [7; 8]. The territory is characterised by the keywords: landscape architecture, architecture and urban planning. Equally, the *Hyllie* area highlights important growth factors in the regional context, developing as the most climatically smart urban area



Fig. 18. Hyllie area, Malmö [created by the author, 2021]



Fig. 19. Emporia shopping centre [photo Una Īle, 2018]



Fig. 20. Multifunctional outdoor space, green roof [photo Una Īle, 2018]

in the Öresund region and setting an example to the world by carefully working on the environmental strategy and climate issues.

The analysed *Hyllie* area is compact and functionally planned in terms of the visual-spatial dimensions of architecture, creating easily comprehensible and easily usable building areas. The principle of mixed building was used, which reflected all the needs of the residents so that they are satisfied and have a desire to stay, to live in the *Hyllie* area. The building structure of the *Hyllie* area is formed by the *Emporia* shopping centre (Fig. 19, 20), the largest in the Scandinavian countries and with a wide multifunctional outdoor space, as well as the Malmö arena and hotel, as well as residential buildings that are rationally and functionally integrated into public buildings.

Conclusions

Evaluating the territories surveyed in recent years, it can be concluded that the visual-spatial dimensions of architecture and the structure of the urban environment are constantly developing and changing, marking certain concepts and principles. Each territory includes quality solutions and multifaceted approaches, thinking about its viability, a healthy and activity-filled living space, which is mutually harmonised with the architecturally spatial techniques. A comprehensive

approach to the development of sustainable architecture and multifunctional outdoor space can be found in all the described areas, which can serve as examples of good practice and systems that can be integrated and developed in the process of revitalization of equivalent territories or in the planning of new buildings and territories. The examples analysed demonstrate that the Nordic region is focused on spatially meaningful

and high-quality architecture, including human-scale proportions, emotional potential and psychological perception of a user of the living space. Along with the elaboration of concepts and development strategies, the existing values of the area, such as industrial heritage or green structures or the proximity of water resources, are taken into account and highlighted.

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Kopsavilkums. Arhitektūras vizuāli telpiskās dimensijas nepārtraukti mainās, arhitekti un pilsētplānotāji apzinās un saprot nepieciešamību pēc veselīgas, aktīvas, dzīvīgas publiskās ārtelpas, veidojot dzīvotspējīgas, ekonomiski un racionāli pilsētvidē piemērotas dzīves telpas. Visaptveroša pieeja ilgtspējīgas arhitektūras un dizaina veidošana ar zaļo struktūru, apvieno kvalitatīvu pilsētvidi. Mūsdienu arhitektūrā viens no perspektīviem vizuāli telpiskās vides un strukturālo formu attīstībās virzieniem ir saistīts ar aktīvu un nepārtrauktu projektēšanas un būvniecības gaitas sintēzi pilsētvidē. Pēdējos gados arhitektūrā ienāk racionālisma un komerciāla rakstura tendences, kas balstītas uz tehnoloģisko progresu un rada nepieciešamību arhitektiem, kopā ar pilsētplānotājiem mērķtiecīgi sadarboties attīstības plānu izstrādē.

Computational Analysis of Biophilic Scale Distributions of Façades in Kaunas City Centre

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Abstract. The results of numerous studies which are performed on the concepts of Biophilic architecture demonstrate that it can influence emotional tension and health of the observers. Moreover Biophilic research exhibits that not only natural plants induce biophilic response, but also artificial, human creations with certain fractal dimensions or distributions of scales can have an impact. In that regard, the aim of this research is to describe the relation between measurable Biophilic properties of façades and the emotional tension inducing health problems measured with the count of medical emergency arrivals in the vicinity of the façades. To achieve the aim several tasks were completed, such as the development of a methodology of façade analysis, and application of it in an experiment to test the validity. The engineered features found by this research are based on statistical analysis of distributions of line lengths and distances between lines in a drawing of a façade. To test the methodology, a linear regression model with six features was trained and it achieved a 37 % confidence, measured with R^2 adjusted, predicting the number of medical emergency arrivals. Simplicity of the model allowed to make additional insights into the specificity of façade properties, and their importance to Biophilia, which establishes the scientific novelty and the significance of this research.

Keywords: Biophilia, distribution, universal scale, power law, linear regression, medical emergency

Introduction

Biophilia in its most basic definition is the love of living things and nature, which some people believe humans are born with [18]. Hence, the usage of the term is slightly different in the concept of architecture. In architecture, biophilia represents the approach to design which contains the characteristics of nature that would assist the users to feel more comfortable to be in these places. However, for the people who live in urban settings, it is not easy to feel comfortable and pleased all the time due to the social stress caused by the cities. Furthermore, according to this approach, inclusion of the properties important to Biophilia that usually are found in nature, to the artificially built environment can help to improve the well-being and the performance of the people. More widespread definition of Biophilia and Biophilic architecture is related to the usage of actual plants in the façades or the vicinity of buildings, contrary this is not the whole scope of this term. It also refers to completely artificial façades without usage of plants that have certain fractal properties of distributions of scales, therefore it is possible that the essence of Biophilia is not in the fact that observable objects are alive rather in the proportional distributions that are naturally found in live plants. Although Biophilic properties are shown to have an impact on people's emotional tension and improvement of health, there is no widespread practice to design façades that utilise this knowledge. Better understanding of the relation between biophilic properties of the façades

and emotional stress, could enable the increase of popularity of less stressful façade design. The creation of a new, more explainable, model using the already known principles of Biophilic design, that could evaluate façades and make statistically measurable predictions, should raise awareness of this unintuitive stress in urban environments.

One of the characteristics of the environment which is proven to affect the well-being and health of people is aesthetic quality. According to Shusterman [15], evaluation of aesthetics occurs by the emotions associated with the bodily and behavioural changes that the objects evoke during the interaction. Therefore, aesthetic quality or features of an object or an artefact can catalyse the interaction. However, there is a lack of control in environmental aesthetics due to two main factors. The first factor is the insufficiency of the available tools which can help to evaluate aesthetic characteristics. The second factor is the belief that aesthetic feeling is only determined by an individual's preferences, and it is subjective. Even though many techniques and methods to create works of art that induce aesthetic feeling are invented, few of them offer means to measure the results. Methods that allow to predict aesthetic feeling are almost never used in professional practice, on the grounds that it is evaluated by the trained preferences. Despite the fact that there are established techniques in academia to train the

preferences of the students, the whole system without scientifically proven control techniques is prone to human bias. This bias is powered by a very strong force - the wish to create something new. The history of creation of the artificial environment dates back to prehistoric times, however the creative process can be broken down by combinatorial analysis as a consequence although combinations are many it is a finite number. Bearing in mind all possible combinations, of which massive amounts could be easily and without doubt or loss of accuracy dismissed by the trained preferences as not associated with aesthetic feeling. Correspondingly clearly aesthetical pieces could also be identified with knowledge of art history. Furthermore, the boundary, the grey area containing doubt and uncertainty which is mostly influenced by bias and masked as fashion. This is driven by pure wish to establish new rules, new patterns, and new styles, and limited by exhaustion of original aesthetic patterns. Ability to know exact aesthetic measurement or prediction of artwork under creation, while it is in virtual form before it is realised with expensive materials and even more biased by investors wishing to have profitable investment could be the key to safe expanding of doubtless aesthetical areas of combinational patterns.

Another branch of research related to Biophilia is concentrating in image complexity measurement with fractal dimension [9], most interesting results are achieved when participants' reaction is recorded and juxtaposed with the fractal dimension of the images participants were reacting to. In the forced choice of image preference experiment 220 participants selected natural or computer generated images measuring 1.33 fractal dimension with little variance [16]. Sensitivity to fractal dimension was also measured in the study that tested 31 participants with an EEG recorder. Recordings show that the 1.32 fractal dimension causes increased activity of alpha waves and decreased activity of delta waves. Alpha waves are associated with relaxed state, and delta waves are associated with sleep states, therefore it could be summarised that images with fractal dimension 1.3 made participants more awake and relaxed [6]. But evidence is not consistent as previous studies found that image preference is correlated with fractal dimension [6], additionally Pollock paintings grew in fractal dimension constantly as author painted more [17], and study of the Pollock paintings preference showed that participants preferred painting with larger fractal dimension up to 1.8 [16]. Fractal dimension can be described as slope of the line in the log-log plot of box counts [9]. Understanding it from this standpoint enables various adaptations of the same idea in the applications where box counts are not available.

In this paper, the theory of the power-law is implemented for understanding the correlation

between the features of the façades of cultural heritage artefacts and the emotional tension and health problems that can be reflected in the count of medical emergency arrivals in the vicinity of the façades. The paper is following the methodology of Salingaros and West for measuring the prosperities of the size distribution on the façades to analyse the changes and the aesthetic synergy of the adjacent buildings. The paper begins by examining the perception of the built environment both as a reflection of nature and alterations which can change the perception and can be measured by the implementation of the power-law. This is followed by giving information about the method and how it is implemented in the experiment. Furthermore, the paper discusses the results of the implementation of the power-law on the building façades in Kaunas and analyses the changes established by the interventions.

Perception of the built environment and its evaluation

In the contemporary world, people who live in urban environments face several aspects of the city on a daily basis, such as its architecture, urban form, street network, and even social networks. All these different aspects establish a reflection on the perception of the built environment that can be measured by different analysing methods.

In his research Salingaros discussed the perspective of fractality and how to use the correct definition of mathematical fractals for analysing the built environment [11]. His essence laid in two principles. Salingaros named it "universal distribution" and "universal scaling". Universal scaling is the principle which governs how building façades should be subdivided. The subdivisions should be in certain proportions where smaller elements should be repeated more than big proportional to size. It is a simplified description of fractal, and the author does not hide it, in fact fractals are the main motivator for his reasoning. His idea could be simplified to: architecture should follow the same principles as nature. This is even more empathised with non-mathematical or rules of thumb which also draw examples from nature and argue how humans are evolved to perceive such a visual environment. Therefore, the fractal features of structures might have an impact on the perception of the built environment, furthermore, architecture and urban structures built in this way might encourage thriving communities.

As the size of neural avalanches rises, length also rises proportionally, this phenomenon is called universal scaling [5]. Phenomena observed in neural avalanches: power law distribution and universal scaling, correspond to Salingaros terms universal distribution and universal scaling, but the difference is that Salingaros does not argue about neural

avalanches, but requirements of building façades [13]. Different scales in rat grid cells also contribute to this field of findings. Similarity of the terms is not coincidence here, phenomena described by the authors in different fields are similar. Salingaros states that façades that do not have these phenomena are not biophilic, and they cause anxiety and illness in humans. By juxtaposing Salingaros theories and finding neuroscientists it is possible to draw the conclusion that the brain is evolved to process information presented in a certain way. There are many power law distributions and universal scales in nature and fractal systems. It is interesting to point out how distributions of brain processes correspond to distributions in nature. If the straight skeleton model is a good representation of how the brain processes visual information, it could be made even better if the skeletons were analysed in the scope of power law distributions.

It is impractical to design an experiment in which one erects an experimental block or even a building just to test how design influences human behaviour. Contrary there are already cities with people and demographic statistics measured, the only thing left is to analyse the buildings. Such a de facto experiment could not bring so clearly stated results as the buildings were not built according to the hypothesis of a paper. Contrary it is possible to settle on less conclusive results for sake of practicality or even the possibility of experimentation.

As Didier Sornette states, nevertheless the uncertainty in life accompanied by potential losses and hazards, it also contains gains. The uncertainty emanates from various dynamical factors, and furthermore, it consists of a succession of choices made by limited knowledge in changing environments [1]. However, even though people have limited knowledge in situations, it is possible to make the choices by predictions which might be shaped by their prior knowledge that people gained through their ancestors. According to Ellard people might not know how to react in an environment that they are not familiar with, especially in the cities, because it is not in the codes of the city people [2]. However, it might be possible to make predictions. Predictions might not always be accurate, but if the distributions are well-defined, the deviations can be calculated. Although, not all distributions fit in a pattern, and furthermore, the process of prediction can also result with the existing uncertainty which generates problems. However, the uncertain characteristic of predictions also makes them interesting and open for scientific observations.

Predictions and logarithmic dependencies can be commonly seen in nature laws. Moreover, it can be ascertained in human senses, such as perception of light intensity, hearing of sound volume and pitch etc. All these senses have logarithmic dependencies

by the power spent to produce the events, therefore, it might be possible to predict them. In statistics, these predictions can be calculated by the assistance of the power-law.

As Yaneer Bar-Yam explains, power law is a relationship between two quantities where a relative change in one quantity establishes a proportional relative change in the other quantity, independent of the initial size of those quantities [14]. Therefore, one of the quantities acts as a power for the other quantity. Moreover, the correlation of these quantities can be defined by tail graphs.

Alterations on the form and function and its effect on perception

If the original function of the structure is not convenient anymore, it is inevitable to provide a new function to the existing building, therefore, it can continue its life. The approach which facilitates giving a new function to a building is called adaptive reuse. However, adaptive reuse is not merely needed to give a new function to a structure, but it is an important strategy for the preservation of the heritage buildings. Furthermore, adaptive reuse can also be adopted for the sustainability of the cultural heritage. Cultural heritage establishes continuity in the society, furthermore it passes the cultural identity to the future generations. As Peter Bullen and Peter Love states, the most successful adaptive reuse projects are those that respect and retain a building's heritage significance as well as add a contemporary layer that provides value for the future [10]. Therefore, adaptive re-use can affect the perception of the people towards the structures, furthermore on the sustainability of the environment.

Architecture has the impact of communicating memory and identity; therefore, it has the ability to communicate values and sense of a place which fulfils the requirement of continuity for future generations. Furthermore, in a broader context, the role of cultural heritage and historical buildings become evident in sustainable development. Assigning new uses for the existing buildings which are abandoned can have an impact on the environment. The sustainable preservation of historical buildings needs to contain the blending of sustainable design, sustainable development, the process of assigning new uses for the buildings can be problematic, and it is important to have a research about the building, the impact of it on the environment, and furthermore its potentials before making the final and the most convenient decision. For achieving that, there have been various models and strategies designed by the experts.

According to the experiment performed by Imamoglu, people tend to prefer the intermediate levels of complexity when it is compared to minimum and maximum levels [7].

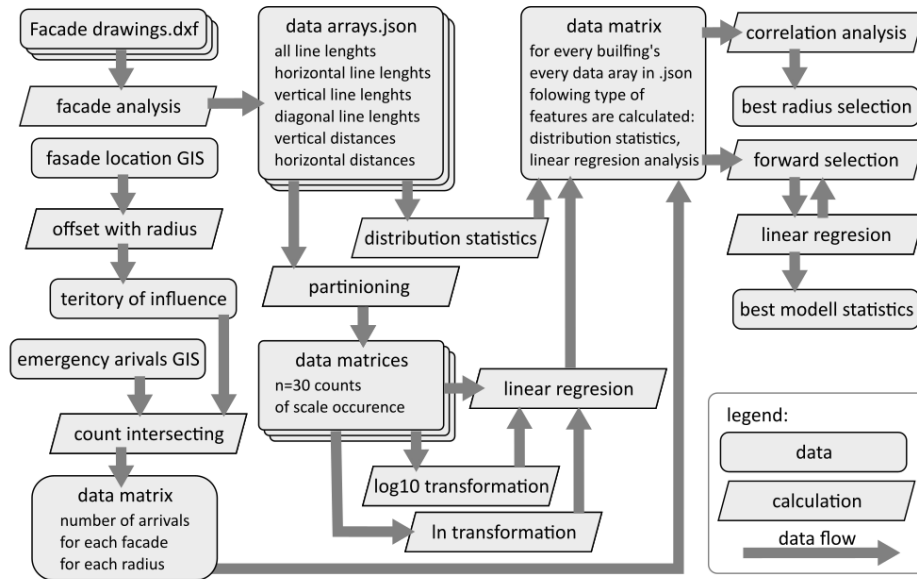


Fig. 1. Data flow overview [created by the authors]

“Organized-complexity: intricate yet coherent designs – and extends to symmetries of abstract face-like structures”. Using the methodology evaluator should choose the mark for each concept: 0–not present, 1–some, 2–abundant. Sum of all marks is a biophilic index showing how healthy influence building makes its users [12]. Although methodology is quite clear and most concepts of evaluation are backed up by experimental research, it is lacking examples of execution. However, the evaluation of the aesthetic preferences can help to understand the approach of people towards heritage buildings in the built environment. When people do appreciate the heritage buildings, they are more likely to spend an effort to protect them. Therefore, what they appreciate and what people do not is an important topic in the process of interventions and alterations for the heritage buildings, both for their life cycle but also for the sustainability. To lay the foundation for the tools that would allow interactive measurement of the façades in the perspective of biophilia, it is required to make a prototype that incorporates and tests all concepts with a small dataset.

Methods

The prototype consists of the following modular parts or modules such as, data acquisition, data preparation, calculation of engineered features, statistical analysis and modelling of medical emergency arrival counts in the vicinity of façades.

Input data of this research consists of 3 parts: façade drawing in dxf format, façade locations and medical emergency arrivals in .shp format. Façade drawings were analysed to create engineered features that will be described in more detail. Engineered features were calculated in two ways: using distribution statistics, and partitioning data

with the same method that is used to make distribution plots and making regression analysis of this partitioned data. Main idea of this branch is that log-transformed partitioned data would be linear, and regression analysis would detect that. Façade locations were offsetted and medical emergency arrival locations that intersect those offsets were counted and assigned to corresponding façades. Multiple repetitions of this process with varying radiuses allowed selection of the most influential radius that was selected as result of correlation analysis. Final linear regression model was made using forward selection. In the rest of this chapter every step of this process will be discussed in more detail.

There were four sources of data acquisition of the building façades. One of the sources was the architect of the building who provided the .dwg drawings of the façade from his reconstruction project (One of the blueprints of the building was achieved this way). Another one of the other sources was Kaunas municipality, which provided paper copies of several façades from their archive. Some façade drawings were also taken from Kaunas historical archive. Additionally owners of one building provided copies of the pages from the building's reconstruction project. However, most of the façades were drawn as a result of a field survey by one of the authors of this research. The preparation of the drawings followed various steps. The first step was measuring and registering information regarding the structures. In this stage, instead of preparing sketches of the buildings, photographs were used by the author. Firstly, buildings were measured at the site by the assistance of a laser-meter. This was followed by matching the measured distances and the



*Fig. 2. Photo of the façade with overlaid drawing
[created by the authors]*

photographs in Photoshop for scaling the photographs regarding the measurements. After preparing the scaled photographs, the buildings were drawn in AutoCAD as .dwg format files.

Façade analysis pipeline was developed in a modular way allowing the inspection of results of each module as they were saved in files on the hard disk. Additionally modules provide a certain aspect of reusability.

To ensure that data is collected accurately, some steps of data preparation were performed manually. AutoCAD provides numerous objects that enable users to work more effectively. AutoCAD's native format .dxf is close sourced, despite the fact that it is reverse engineered and many details about its inner workings are known, the .dxf format was chosen which is also supported by AutoCAD. It does not support all types of objects that .dxf supports, but instead documentation is available online resulting in several open source libraries that allow interaction with this format being created. Advantage was taken of those libraries and for that purpose files were converted to .dxf format. Façade drawing files were organised to have one façade per each file. Building façade drawings are divided in separate files and saved in AutoCAD open ". DXF" format. The "explode" command was used in AutoCAD to convert most objects to lines. However, not all objects were able to be converted to lines with AutoCAD explode command. In that regard, those objects were treated as special cases in the analysis module.

In the façade analysis module, line lengths and distances between lines were collected, and they were sorted in different groups, such as: vertical, horizontal, and diagonal. There was an additional group where all line lengths were collected without filtering. In the AutoCAD package every line is stored as a separate object. The script which was used in this research accesses all objects, filters lines, extracts coordinates, measures distances, compares coordinates of start points and end points (to detect verticality and horizontality). For every .dxf file contained in directory and generates a .json file containing arrays of line coordinates (for double

checking data integrity), line lengths, and distances between lines. Line lengths of vertical and horizontal lines were just absolute differences between corresponding axis coordinates of endpoints. Lengths of diagonal lines were calculated using Pythagoras theorem. Distances between vertical and horizontal were measured the same as distances but between closest lines that have intersecting projections in the perpendicular axis. Although this was a seemingly simple concept, it was somewhat difficult to achieve, therefore a separate module was developed to test it thoroughly. Data was grouped by line orientations into vertical, horizontal, and diagonal. There was no diagonal group for distances, because angles varied and there was no simple concept to measure distances between them.

Several object types: splines, circles and arcs do not convert into lines with usage of "explode" command in AutoCAD. However, the research aimed to use the information that these objects hold as well, therefore, the objects were converted before they were sorted out as lines. Spline objects have an array of "fit_points" which are treated as polylines and every line segment is added to corresponding sets. From the circle object coordinates of center point and radius were taken and used to calculate edges of the octagon. Edges were treated as lines and added to corresponding sets resulting in 2 horizontal lines, 2 vertical lines and 4 diagonal lines. From arc object coordinates of center point, radius, start and end angles were taken and used to calculate three lines and added to corresponding sets. Data collected in such way was not analysable with statistical methods that required to have data matrix, because lists of lengths and distances of lines in the drawing varied in length, and data matrix requires everything to be the same length, therefore data was additionally aggregated using various statistical functions that aligned data to fit into data matrix, additionally selected aggregation methods took this research closer to a theoretical background.

Feature engineering

Second module performs analysis of lengths and distances arrays using "statsmodels" library, using Kolmogorov-Smirnov test on a list of available distributions in the library, among which is most important for this paper power law distribution. Some distribution functions require no parameters therefore tests are straight forward, contrary others require one or multiple parameters. Functions requiring multiple parameters were discarded as there were no strong hypotheses attached to them, contrarily one parameter distribution functions were tested 10 times by scanning beta parameters from 0.0 to 2.0. The range was chosen to capture the power law distribution parameter of 1.3-1.5 discussed previously in more detail.

Although several statistical distributions tests derived from power law distribution are also related to fractal dimension there is potentially another way to test it using sets of line lengths and distances. In the essence of fractal dimension analysis, named box counting, there is a fixed size box in which details of analysed drawings are counted. There are other fractal analysis methodologies that are not using boxes, newer the less fixed size of test area is used. In the effort to stay close to this methodology, it was chosen to partition line lengths and distances between lines as it achieved when calculating histogram plots, as bare data cross plots: line counts versus line lengths were very jagged and not analysable. Data was partitioned, by calculating 30 bucket histograms for each array. 30 buckets were chosen as a rule of thumb minimum requirement to perform linear regression analysis, also to provide consistency as array sizes that vary from 33 to 35079. Also following the methodology of calculating fractal dimension as closely as possible correlation analysis is performed on all arrays. One statistic of linear regression analysis, that is of the most interest for this study, is slope coefficient of line in log plot. This is achieved by log transforming the data before linear regression analysis. Contrary this is not enough because literature analysis results call for a certain slope coefficient which is between 1.3 and 1.4 depending on source. Therefore for the scope of feature engineering the new variables were defined as absolute difference of slope coefficient and 1.35.

Sometimes significant parameters are found in unexpected fields: one study found that GIF compression algorithms effectiveness is a good predictor of beauty judgments recorded from participants of experiment [4]. Therefore a decision was made to test as many engineered features as it was possible to generate in an effective manner.

All engineered features have their own ranges of resulting statistical values, therefore without taking into account the individual characteristics of each statistic interpretation of the final regression model would be very complicated. To simplify this problem, all engineered features were normalised to min-max, hence the trade was made to sacrifice the ability to interpret the actual statistic to gain the ability to compare them with each other. Potentially it is possible to make additional compensation for the inability to interpret engineered features by visually comparing façades of extreme examples of the statistical values in the question.

Geographical data: locations of façades and arrivals of medical emergencies were aggregated using GeoPandas Python package. Façades were converted to territories of influence using the buffer method. Resulting offsets were used to count intersecting emergency arrival points using spatial

join method. Although this procedure is simple and could be done manually with GIS software, scripting allowed repeatable processes that could be performed on several buffer radiuses with relatively little effort.

Resulting data matrices were joined together based on façade identification codes consisting of shortened street name, number of buildings, and façade orientation. Multiple radiuses of façade influence allowed the selection of the most influential radius using analytical methodologies which was used to make a final linear regression model that allowed the inspection of most influential façade analysis features.

Results and Discussions

Preliminary analysis allowed the identification of two buildings that were outliers in the dataset. One of them was sourced by the author of the building's reconstruction; it was outlier in the engineered features. It is suspected that underlying pipeline, or the philosophy in the process of making façade drawings or using certain functions to draw façades resulted in this extreme discrepancy. Additionally, this building's reconstruction was followed by controversies which resulted in license loss and informal policies change in the organization that is responsible for heritage conservation. Although it is not believed that engineered features of this building could predict the controversies it suffered, it is not possible to test it and this is not subject of this research, therefore it was found safe to remove it from the dataset. Another outlier was in the number of emergency arrivals. It was a large police station, although the under mechanism is not known regarding what is happening, therefore, it is assumed that it is related to organizational operations of the police station and the medical emergency services. Those data points were not filtered by excluding points labelled "patient transfer". Additionally, it could be that victims of crime walk to the station and then a policeman calls for a medical emergency. For the reasons discussed above, it was considered safe to remove this building from the dataset as there is high probability that the accumulation of emergency arrival points near it has more to do with label limitations of the emergency arrivals database or the organizational reasons. Those outliers were affecting correlation analysis in numerous variable combinations, as it was visually apparent in the scatter plots. Therefore, the following analysis results will be with the dataset that has those outliers removed.

To select the most influential radius correlation analysis was repeated for every radius and the best feature along with its correlation was selected.

In the figure nr. 3 it is possible to see that best parameters are found by scanning through distance

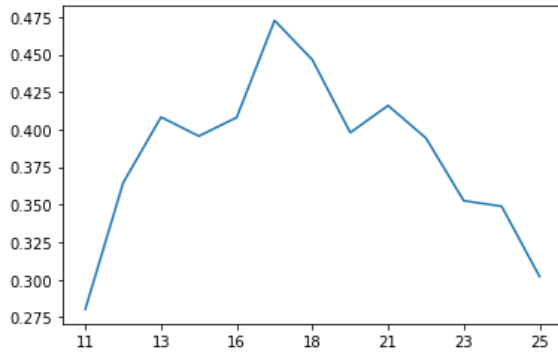


Fig. 3. Best Pearson correlation change [created by the authors]

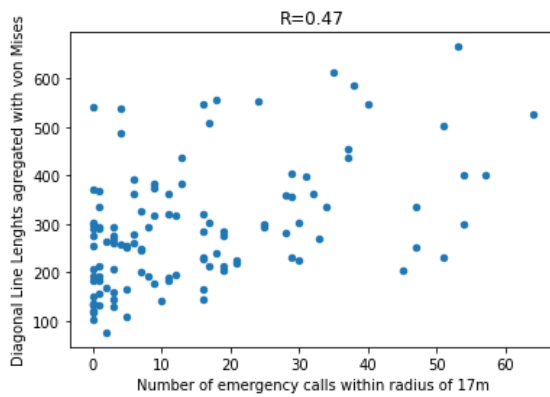


Fig. 4: Scatter plot of engineered features calculated from diagonal line lengths using the von Mises statistic versus number of emergency arrivals in 17 meter radius [created by the authors]

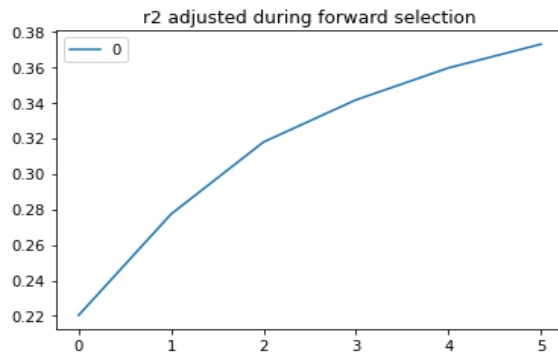


Fig. 5. Change of R² adjusted in the best model during the forward selection process [created by the authors]

radiuses. The features that produce best correlation values differ depending on radius. For the radius of 11 meters best correlation was calculated with all line lengths with inverse gaussian statistics. For the radius range from 12 to 24 meters the best correlation is for diagonal lengths that was calculated with von Mises statistic. From 12 to 17 meters the dominating component was uniform distribution, but for 23 and 24 meters the normal distribution component was more important. For 25 meters and above horizontal lines were dominating. Most relevant features will be discussed later. This analysis is used for best radius selection, and

later analysis was concentrating on the model's radius with best correlation that is 17 meters.

Engineered features calculated from diagonal line lengths using the von Mises statistic had weak Pearson correlation with the number of emergency arrivals in the 17 meter radius ($R^2=0.47$). In the scatter plot (Fig. 4) a slight visual trend is visible, a linear model with only this feature would have high error values, nevertheless it is possible that other features will compensate for that noise and make the model more accurate.

Using the most influential radius which was selected using correlation it was possible to make regression analysis including more engineered features and hopefully produce a model with less error. Linear regression models are very robust in usage because they can be explained and understood, contrary to many newer machine learning approaches. Despite the existence and spectacular results of machine learning specialisation named “explainable AI”, more difficult models do not approach the level of expandability linear regression has. Although it is possible to make a regression model using all engineered features it would not be very comprehensible considering the number of features and the probability of features not contributing to models accuracy. There are multiple methodologies available for feature selection, upon trying several of them stepwise selection was selected for the final model. Despite the critique of the forward selection model it is also known that it is producing acceptable results when sample size is low and suggested models to replace stepwise selection are not suitable for such small sample size [3]. Forward selection is a type of stepwise selection model, where one starts with a small model with only one feature and tries to find the next one that increases chosen measurement most. In this case it is R^2 adjusted. To describe in more detail, the algorithm consists in two nested cycles, a deeper one which is repeated most times, cycles all features in the “available” list, makes linear regression models with them one by one and measures R^2 adjusted. Then a higher order cycle which only repeats as many times as it chooses to select features, picks the feature that produced the best model and removes it from the “available” list, also adds it to the “selected” list. Therefore, in the next iteration of deeper cycle models are made including all features in the selected list and one feature under test from the available list. This is time consuming but useful when there are many features available as in this case.

Dynamics of R^2 adjusted was measured during forward selection algorithm execution, which shows

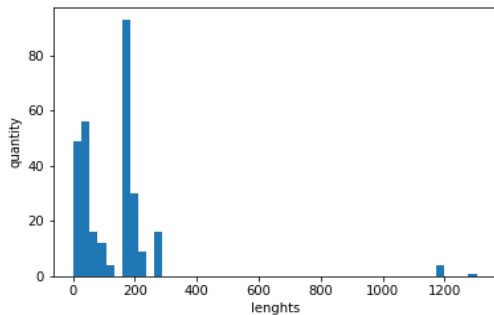


Fig. 6. Drawing of Laisvės al. 94 façade that ranked near the top of ranked façades by the feature that was used for the second coefficient of the model [created by the authors]



Fig. 7. Drawing of Laisvės al. 88 façade that ranked near the bottom of ranked façades by the feature that was used for the second coefficient of the model [created by the authors]

LA_94 vertical Histogram



LA_88 vertical Histogram

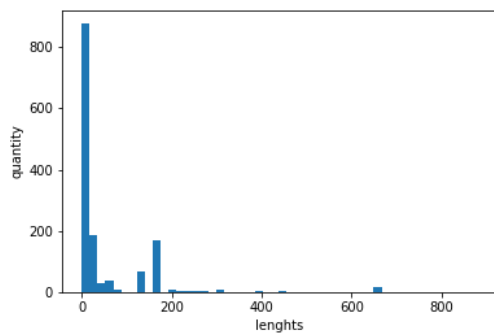


Fig. 8. Histograms façades ranked high and low in features derived from vertical line lengths [created by the authors]

that every next feature that is selected improves the model with a lesser amount. Speed of improvement decreases. The algorithm was stopped as 6 features were selected to achieve balance between accuracy and explainability of the model. Additional motivation to stop is to address the flaw of the forward selection model as it was shown that there is probability to select features that do not improve understanding of actual phenomena [3].

Selected final models accuracy measured by R^2 adjusted statistics can be interpreted in the following way: using six engineered features from the façade analysis model can explain 37% of emergency arrivals in locations of the façades, and inductively it can explain occurrence of health issues with similar degree. Therefore, it would be possible to create façades by using its knowledge with the intention to reduce a similar amount of emergency calls by removing the cause of health issue occurrence. In the following paragraphs engineered features will be discussed to gain insights of how the knowledge gained by the model would be possible to use in improvement of façade designs that reduce stress and health issues. It would not be correct to make conclusions about the model in the classical approach because the model's endogenous variable does not have predictive purpose, or at least argument could be made that it would be more correct to treat it this way. It is possible to interpret the coefficients by forming such a conclusion that reducing this coefficient by one, emergency per certain time would be reduced by a certain number. Instead, a decision was made to treat them as unitless numbers of potential to influence human stress and health issues. Although this approach omits potential explicitness that model provides it also makes it simpler, which will help to include explanations of meaning of engineered features.

Linear regression model has an intercept which graphically represents the point on the Y axis where the line of the model intersects when all the features are equal to zero. It is negative, therefore it can be assumed that the model predicts that there will not be such a case that the façade will have all engineered features equal to zero, because it is impossible to have negative emergency arrival numbers.

The strongest parameter was assigned to a feature that is calculated by testing diagonal lengths with von Mises ($\beta=0.05$) statistic. This statistic is the result of a test that tests for von Mises distribution also known as circular normal distribution. As it is parametric distribution tests, as parameter β is approaching zero, the test approaches the state where it tests for uniform distribution. Considering that the engineered feature was generated using it with $\beta=0.05$ the distribution under test is a partial distribution



Fig. 9. Drawing of Kęstucio g. 15 façade that ranked near the top of ranked façades by the feature that was used for the third coefficient of the model [created by the authors]



Fig. 10. Drawing of Laisvės al. 53 façade that ranked near the bottom of ranked façades by the feature that was used for the third coefficient of the model [created by the authors]

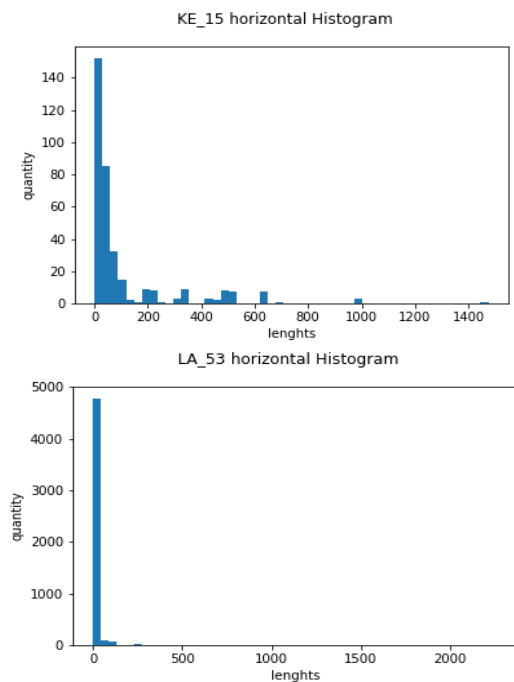


Fig. 11. Histograms façades ranked high and low in features derived from vertical line lengths [created by the authors]

between uniform and circular-normal distribution, being much closely similar to uniform. Although circular-normal distribution was an important component for winning the forward selection process it is minuscule and adds additional complexity in interpretation, therefore the interpretation of this component will be dismissed. To explain equal distribution white noise is often used as an example, where all the frequencies of sound are on the same volume. White colour is where the electromagnetic waves approach our eyes in the same levels on all visible frequency bands. Uniform distribution is when there is a similar count of data values in all data ranges. Looking from probability perspective: the probability of encountering any value in the sample is the same. To interpret this feature it could be stated that uniform distribution of diagonal line lengths in the façade is inducing stress and can trigger health problems. Regression resulted in coefficient 43 which will not be interpreted classically but remembered as benchmark value for comparison with other features in the future. Unfortunately it was impossible to gain intuition visually inspecting façades ranked by this engineered feature.

The Second strongest parameter was assigned to the feature that is calculated by normalising vertical lines with base 10 logarithm and testing them with F-statistic after the regression analysis of distribution curve, which is testing if the regression model has predictive capability. Larger value means better predictions and more linearity caused by logarithmic transformation of data. It follows the assumptions made in literature analysis analogously as the first feature. F-statistic is calculated including the slope coefficients of the model, therefore slope of the linear model is important for this feature. Regression resulted in a coefficient 35 which compared to this model's strongest coefficient that is 43. It has 19% less influence on average. Visually inspecting façades in the extremes of the list ranked by this engineered feature we can identify some key properties. As this coefficient is positive higher ranked façades are believed to be inducing more stress to the spectators. Façade Laisvės al. 88 (Fig. 7) has decorations and more variation in the frames of windows and ranked low for this feature, opposed by façade of Laisvės al. 94 (Fig. 6) which has monotonic modern style and ranked high for this feature. The same conclusion can be drawn visually inspecting histograms where in a high ranking histogram we can see a second strong peak which is even stronger than the first peak. This is caused by a large amount of middle length lines. This histogram differs greatly from power-law. By comparison histogram of façade that ranked low in this feature is more compliant to power law with few exceptions. Those exceptions could be the

reason why the actual best engineered feature is not a statistical indicator of power-law distribution test.

The third strongest parameter was assigned to a feature that is calculated by normalising horizontal line lengths with natural logarithm and testing them with Jarque–Bera test [8]. Jarque–Bera test is test of normality in the sample distribution, it produces its main statistic which to interpret its sample size must be taken into account, but algorithm selected not its main output but p-value which is probability that the null hypothesis is rejected, therefore sample size does not affect it. Larger result Jarque–Bera test suggests that sample has more normality, therefore sample before log-normalisation was lognormal and not distributed according to power law. As this number increases the distribution line moves from (hypothetically) power-law distribution to lognormal distribution. This could be caused by lack of small details confirming the literature analysis results. Additionally, it provides insight into most common distribution nonconformity with power-law, which is so common that it is a better predictor than test for power-law distribution itself. Regression resulted in coefficient 16 which can be compared to models' strongest coefficient that is 43. It has 63% less influence on average compared to the most influential feature and 55% less influential than the second feature. Visually inspecting façades in the extremes of the list ranked by this engineered feature we can identify some key properties. Façade Laisvės al. 53 (Fig. 10) has decorations and more variation in the windows horizontally and it ranked low for this feature, opposed by façade of Kęstučio g. 15 (Fig. 9) which has no decorations and few types repeated windows and ranked high for this feature. The same conclusion can be drawn visually inspecting histograms where in a high ranking histogram we can see multiple small peaks in the distribution contradictory to low ranking distribution, which has exceptionally high count of small detail and no visually detectable peaks after. High peak in short horizontal lines must have been caused by the decorated handrail in the balcony.

The fourth strongest coefficient was assigned to a feature that is calculated by testing horizontal distances with von Mises ($\beta=0.05$) statistic. This feature was discussed before, therefore to conclude having in mind that a β of 0.05 makes this statistic largely a test for uniform distribution it can be concluded that when distribution of horizontal distances between vertical lines approaches uniform distribution, the façade is more likely to induce stress and can trigger health problems. Visually inspecting façades in the extremes of the list ranked by this engineered feature we can identify some key properties. As this coefficient is negative lower ranked façades are believed to be inducing more stress to the spectators. Façade Mickevičiaus g. 45

(Fig. 13) has decorations and more variation in the distances between windows and decorations horizontally and it ranked low for this feature, opposed by façade of Kęstučio g. 3a (Fig. 12) which has no decorations and uniformly distributed windows and ranked high for this feature. The same conclusion can be drawn visually inspecting histograms where in a low ranking histogram we can see a second semi strong peak in the distribution contradictory to low ranking distribution, which has one high peak and little noise after.

The fifth potential was assigned to a feature that is calculated by testing horizontal distances and testing them with F-statistics after the regression analysis of the distribution curve. F-statistics was discussed before in the previous paragraph about the second strongest coefficient, but the difference here is that data was not log-transformed. Therefore if the distribution of the distances of horizontal distances are likely to be modelled with a linear model, then the façade is more likely to induce stress and can trigger health problems. Façades ranked similarly but in reverse compared to façades discussed in the previous paragraph. It is expected as the source of distribution is the same but coefficient in the model of previous feature was negative, and for this feature is positive.

The sixth feature by absolute potential is calculated by normalising diagonal lengths with natural logarithm and testing them with Jarque–Bera test. Jarque–Bera test was discussed before in analysis of the third feature. Interesting thing about this feature coefficient is that it is negative, therefore it means log-normal distribution in the diagonal line lengths is reducing stress and probability to trigger health problems. As with previous feature that were sourced from diagonal lines it was impossible to gain visual insights from top and bottom ranked façade comparisons.

Variety of sources of feature calculations that were selected by forward selection indicate that all filters of lines were important for model improvement. Specialisation of the engineered feature by choice of certain statistical function or method allowed to capture most relevant information about the feature. It is indicated by the fact that for the next feature a different type of information source was chosen. For example, the strongest coefficient was for diagonal line lengths and another feature calculated from diagonal line length source was not chosen twice before other sources were depleted.

Buffers with radiuses are a poor visibility model. Although it definitely could be improved it is not as bad as it could be perceived at the first glance. It is true that it could include medical emergency points from which the façade is not visible, although from manual inspection it is possible to state that it is



Fig. 12. Drawing of Kęstučio 3a façade that ranked near the bottom of ranked façades by the feature that was used for the third coefficient of the model [created by the authors]



Fig. 13. Drawing of Mickevičiaus 45 façade that ranked near the top of ranked façades by the feature that was used for the third coefficient of the model [created by the authors]

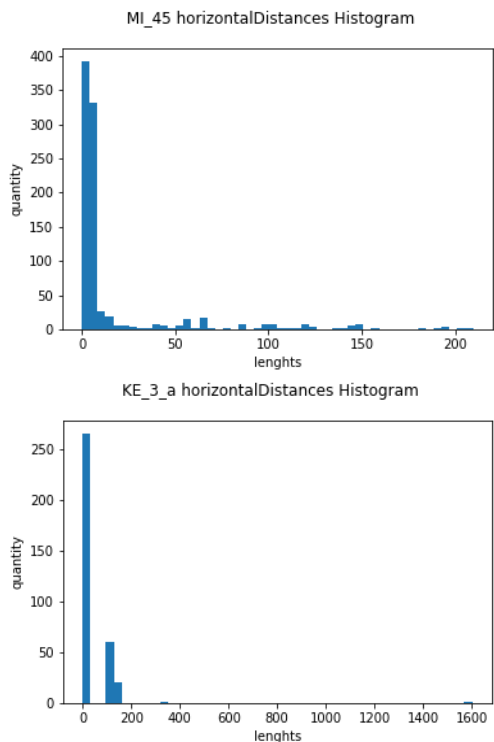


Fig. 14. Histograms façades ranked high and low in features derived from horizontal distances between lines [created by the authors]

rarely the case. This is mainly caused by the physical possibility of arrival location. For other cases it can be explained that the façade was perceived just before the emergency.

Conclusions

Final model can explain 37 % of emergency arrivals just from façade analysis methodology developed during this research. This number alone should be enough evidence that façade design should not be taken lightly. It should be used as motivation to develop further analysis methods and tools that could be used by architects to design façades with stress reduction in mind.

It is interesting that almost all possible strategy variants to calculate façade measurements (except all line lengths and vertical distances), played a significant role in the modelling. Strongest being lengths of diagonal lines, and lengths of vertical and horizontal lines following. Distances between the lines were less important than lengths of the lines, however, lengths of the vertical lines were found to be more important than lengths of horizontal lines. Contrary, horizontal distances were more important than vertical distances, as vertical distances were not selected with the forward selection model, but horizontal distances were selected twice. It still makes vertical lines more important because horizontal distances are measured between vertical lines.

The findings regarding the impact of the lines can be an essential element to use on the design process of the façades of new buildings. However, it would not only affect the new designs, but it can help to make the decisions regarding the alteration of already existing buildings as well. Even though it might be thought that the mass gives the effect of being vertical or horizontal in a design of a structure, actually the small elements have an impact as well, as it was demonstrated in this research. Even the divisions of the window frames and the transition which is gained by ornamentation or any other element can assist the perception of the façade. Assignment of different statistical tests and functions in a final model indicated that different orientations are treated differently, not only by the model but intuitively also by the human mind.

This approach of not looking at adjacency in the perceived façade is somewhat similar to the “bag of words” methodology used in computational linguistics. It is a useful concept that is used in several methodologies in this field to achieve good results. As the computational linguistic models improve when adjacency is included, this model could be also improved. Contrary to such a model much more data is required and it itself would be significantly complex and less interpretable.

Min max normalisation of engineered features made this model specialised to this particular dataset. Any façade that pushes statistics beyond the range of current data will be scaled beyond zero and one limits of the scaled data. This poses no problem because the model is linear. But it raises a question about the meaning of those features, which is now acquired by comparing the façades with extreme values. This is possible continuation of the research, to procedurally generate parametric façades, for the purpose of finding extreme values that still work as façades.

The difficulty of acquiring intuition that is required to use the findings of this research in practice is untested. It should be possible to make a diagnostic tool that automatically shows values of important features, additionally uses predictive capability of this model to help gain this intuition. Such a tool could be integrated as a plugin in a selected CAD or BIM program and provide diagnostic values for the user by analysing the façade under design.

Model potentially could be improved by the addition of omitted statistical functions. There are 99

statistical functions for calculating distribution statistics in the SciPy library. They were not all used for feature engineering trying to avoid feature explosion caused by two dimensional scan of the parameters. Continuing the same strategy as it was used in this study to scan parameter 10 fold, two dimensional scan would produce 100 features, utilising all 25 double parameter functions would result in additional 2500 features.

Another possible improvement could be made by utilizing parametric log-transformation before the linear regression model of partitioned line length and distances.

Most top and bottom ranked façades by features used in the final model were identifiable visually from the histograms of corresponding feature sources, namely lengths or distances by similar properties like: presence and size of multiple peaks in the histogram. Contrary functions that produce best aggregations of those distributions differ. Therefore it should be possible to find or make new statistical functions that would be specialised to diagnose scale distributions in façades.

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Kopsavilkums. Daudzu pētījumu rezultāti, kas veikti par biofilās arhitektūras jēdzieniem, parāda, ka tā var ietekmēt novērotāju emocionālo spriedzi un veselību. Turklāt biofilie pētījumi liecina, ka ne tikai dabiski augi izraisa biofilu reakciju, bet var ietekmēt arī mākslīgi cilvēka radīti darbi ar noteiktiem fraktāļu izmēriem vai mērogu sadalījumu. Pētījuma mērķis ir aprakstīt saikni starp izmērāmām fasāžu biofilām īpašībām un emocionālo spriedzi, kas izraisa veselības problēmas, veicot mērījumus fasāžu tuvumā. Mērķa sasniegšanai tika izpildīti vairāki uzdevumi, piemēram, fasādes analīzes metodikas izstrāde un tās pielietošana eksperimentā. Šajā pētījumā atrastās inženierzinātņu iezīmes ir balstītas uz statistisku analīzi par līniju garumu sadalījumu un attālumiem starp līnijām fasādes zīmējumā.

Perception of Cityscape of the Central Part of Kaunas and Sociocultural Aspects Determining It

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Abstract. This article deals with peculiarities of Kaunas centre cityscape perception and the determining socio-cultural factors. Important elements creating unique view of a location and identity are related to the period's history, culture, political situation, features of the location natural basis, as well as individual's-observer's education, personal qualities, aesthetic and cultural sophistication. The territory of Kaunas city centre was selected for the case study. It is characterized by unique natural, historic, cultural conditions and high information-emotional potential. During the research priority ranking concerning significance of cityscape elements groups and experienced psycho-emotional senses was conducted. Furthermore, the correlations between the distance of object observation, heights of observation points as well as movement mode selection and personal factors such as gender, age, occupation, and education based on statistical dependencies were identified. The obtained results explain the principles of Kaunas centre cityscapes perception.

Keywords: urban landscape, cityscape, city view, Kaunas, sociocultural factors

Introduction

Research of the impact of sociocultural factors on cityscape perception and development is a complicated and versatile field involving distinct subjects. Physical behaviour and emotional perception of individual's surroundings allows understanding the correlation between socio-cultural content of different cities' cityscape spatial structure and geographical location, natural conditions, historic periods as well as spatial, political and economic environment. Investigations of sociocultural nature were conducted by J. Jacobs, K. Lynch, L. Mumford, H. Molotch, W. H. Whyte. In Lithuania sociocultural environment and context over the years have been researched by J. Vanagas, T. Grunskis, D. Bardauskienė, K. Zaleckis. Moreover, R. Buivydas, J. Jurevičienė, V. Petrušonis, J. Kamičaitytė, R. Ribelytė and others have published several articles.

Both locals and incoming observers recognize cityscape via its form, style, configurations of urban spaces, relation with natural basis as well as information coded by time and history symbols of architectural objects. Factors constituting sociocultural environment, namely education, art, culture, religion, recreation, societal activities reflecting peculiarities and level of society's life form the physical environment of the city. Social need for certain objects, areas and activities determines differences of establishing urban and green spaces.

Cityscapes of different cities can be directly perceived via human-created physical objects (their style, composition, form, scale, colours, etc.) and

local natural environment (climatic conditions, relief, water reservoirs, flora) as well as panoramas, silhouettes, and local visual spaces formed by anthropogenic and natural components. Landscape perception is also determined by sociocultural factors such as culture, history, education, traditions, religion, etc. All these factors by interacting create a specific model of a city during a historic period determined by certain sociocultural processes prevailing at that time within the society.

The importance of the research from the theoretical point of view is based on priority perception/distinction of urban structure elements within city landscape by K. Lynch. Priorities are arranged on the basis of Kaunas city inhabitants' survey (statistical reliability was identified). The obtained research data can be applied in practical activity of both city landscape design, and urban planning and design.

The main aim of the research is to analyse landscape perception peculiarities in the central part of Kaunas city, determined by sociocultural aspects. The tasks of the research are the following: to establish factors significant for the perception of the landscape of Kaunas city centre and its identity; to assess priority of K. Lynch urban structure elements evaluating their significance perceiving the cityscape of Kaunas central part; to determine the importance of senses experiencing landscape of Kaunas city centre; and to analyse the correlation between movement modes and the elements of city's mental view as well as the size of perceived visual spaces and priorities of senses.

Methods

The method of bibliographic sources, scientific publications, electronic resources summary and analysis was applied. In addition, sociological surveys, designing mental maps and observation (location photofixation) were employed. Survey results were processed using SPSS software. Category data was analyzed by chi square (χ^2) criterion. Pearson linear correlation coefficient (r_{xy}) was used to identify relations between range variables whereas for evaluation of several independent range samples Kruskal-Wallis test was selected. During the research the obtained data was compared and summarized.

When analysing subjective perception of the environment as well as conducting empirical assessment of attitudes Semantic Differential Scale (SDS) is frequently applied [15]. Semantic Differential Scale is composed by employing polar adjectives, which helps assess individual's reactions to a certain object or phenomenon. The other frequently used research method is K. Lynch's (1960) behaviour method concentrated on a very specific perception categorization of five basic structural elements of the central city part, that is, nodes – squares, crossroads; paths – streets, trails, sidewalks, other pedestrian routes; edges – walls, fences, buildings; districts – large city areas; landmarks – iconic buildings, spatial structures, reference signs. Behaviouristic method (that, is, how a person feels/behaves within the area) helps reveal socio-cultural aspects of cityscape perception and formation while by applying this method in environment formation practice one can ensure psychological acceptability and readability of different city's areas [27]. The importance of this method by assuring legibility of city's spatial structure as one of the most psychologically preferred environment next to coherence, complexity and mysteriousness, [7; 9] determined the application of the method for the research.

Research object – landscape of Kaunas city's central part. The territory was selected due to unique natural, historic, cultural conditions as well as information-emotional potential of the landscape and possibilities of its visual perception.

The conception of cityscape

Urban landscape dates back to the emergence of the first cities. It developed together with cities [9]. Famous American landscape architect, journalist Frederick Law Olmsted (1822–1903) was the first to use the concept of urban landscape as a specialized term [17; 6; 10]. The famous landscape architect identified urban landscape with different green spaces and their elements of various purposes. In the 19th century he put the basis for contemporary conception of the city as a unified part of the ecosystem.

In the middle of the 20th century influential British architect T. G. Cullen, who developed the new methodology and theory of city's visual analysis and design, based the concept of urban landscape encompassing visual and structural integration of buildings, streets, and places that constitute the city environment. The author described urban landscape as the harmony/art of proportions of all these elements. The other famous British landscape architect professor B. Hackett (Brian Hackett 1911-1998) called landscape as the view (i.e. buildings, pavements, trees, grass, topography, etc.), which can be overlooked by a human eye. He divided urban landscape into green (soft) and hard, by emphasizing the importance of the former and related it to opportunities of improving citizens' social behaviour as well as physical and mental health.

The terms "urban landscape" encompassing the words of different meanings defines the quality of environment's physical factors [2], develops relationship between city environment and a human being [3], established by certain social processes [14, 12].

Lithuanian engineer-architect, habilitated doctor of humanitarian sciences K. Jakovlevas-Mateckis in the first volume of his monography "Urban landscape architecture" provides explanation of urban landscape (anthropogenic, urbanized) as changed, affected, maintained and developed by a human being. The author indicates that in scientific literature such a type of landscape is frequently known as urban landscape. Literal formulation of the conception developed by the author is used in the Description of Landscape Policy Directions of the Republic of Lithuania (2004–2020).

A significant part of world and Lithuania's urbanism and architecture theoretists (L. Mumford, K. Lynch, G. Cullen, T. Turner, S. Bell, G. Daniulaitis, K. Zaleckis, Konstantinas Jakovlevas – Mateckis, A. Vyšniūnas, etc.) use the term *cityscape* for urban landscape. The term Cityscape (international Encyclopaedia Britannica) was first used in 1856. It is introduced as a shorter version of urban landscape equivalent. A. Vyšniūnas (2013) suggests using Lithuanian terms that are closer to international ones in order to avoid misinterpretations. He defines urban landscape as landscape architecture in the city. By emphasizing multifaceted relation between the city, its culture and deep cultural processes K. Zaleckis (2002) extends the boundaries of urban landscape definition from the city view to the processes occurring within the city, reflection of cultural phenomena and changes by calling it a hologramic view allowing visual perception of invisible phenomena [27].

Summarizing one can claim that urban landscape (cityscape) combining different periods, urban compositions, architecture, parks, garden styles, colour gamut, developed by different natural conditions and historic circumstances is further changing. Such a peculiar view, frequently recognized from unique dominants and their ensembles, distinguishes the city from the other: by historic sense it reflects different periods of the city's past; from social sense it complies with political, economic, cultural needs of the society during different periods while from a philosophical point of view it reflects city's events, positive and negative changes as well as the relation between the city and a human being. The concept of cityscape in the article will be analysed as a visually observed part of the city formed by different sociocultural processes.

Cityscape perception

Cityscape can be perceived in two ways, namely mentally and physically. These two ways closely interact with each other. K. Lynch regards mental experience process as important to an individual and considers it as the product of direct sense, past experiences and memory. He constructs urban view from three constituents: identity (recognition of separate objects), structure (spatial relations between objects) and meaning (abstract information). These three components act together and are significant for an observer both practically and emotionally. By assessing the environment of the cityscape, a city observer creates his/her individual city view/image, which can change with time regarding the circumstances. Individual city images can be combined into one collective image [12], which finally creates local identity and spirit, peculiar atmosphere of a location known as *Genius loci*. According to S. Kirvaitienė (2004) [11], mental perception of cityscape develops when an individual directly or indirectly faces a city and its environment. It is a changing process perceived by one's mind and developing by layering of all senses rendered by individual's sensory organs (images, perception of physical, social, virtual environment, multisensorial units).

An individual receives 70–80 % of information about physical environment by sight [1]. City view (physical) is seen, covered and perceived more easily during direct visual contact. In his conception of cityscape K. Lynch (1960) marks separate visual accents, which facilitate reading of city images, develop the easily memorized sign system that helps guide himself/herself within the city. The city view is described by physical objects organized into mental maps, composed of five basic elements such as paths, streets, other pedestrian routes; edges, perceived or observed like walls, fences, buildings;

districts, relatively big city quarters distinguished by their identity and character; nodes – the main and local intersection points; and easily identified objects – landmarks. J. Vanagas (2008) specifies observer's capacity to cover certain parts of the urban object. "Artistic image of such an object in observers and city dwellers' consciousness is established as a chain of local symbols, i.e. the sum of visual nodes, spaces and volumes constituting city signs and representing the object" [24]. The author considers the central part to be the most important element of the spatial structure of the city and the medium of material and spiritual culture, where normally the most significant socially buildings featuring exclusive architecture as well as streets, squares, equipment, monuments and green areas are found, and intense inhabitants' societal and social activity is happening. Towers, high-rise buildings, domes, dominants create individual expression peculiar for a specific city and mark the core location of the city.

According to K. Zaleckis, I. Gražulevičiūtė-Vileniškė, J. Vitkuvienė [28] in history of urbanistics there are a lot of examples where cityscape is treated as cultural artifact on the basis of its characteristics. Authors claim that such reading is equally important for a representative of a specific culture using its spaces and a guest since the qualities determining cityscape reading are essential as far as cultural identity is concerned.

Results

Empiric sociological investigation of Kaunas centre landscape perception correlations

In order to analyse aspects of perceiving separate elements in Kaunas centre cityscape which are determined by the sociocultural context empiric-sociological research was conducted. The research object was landscape of Kaunas city (Lithuania) centre. The research data was collected during the period between 02 11 2019 and 23 03 2020.

The method of selecting sociological research sample was based on the random principle, i. e. all population individuals have the same possibilities to be chosen as samples. Non-probability sampling was employed to select the research groups, i. e. the distribution of subjects in the population group is not known and the group is composed randomly.

Qualitative research method – respondents' survey (conducted by the questionnaire) was employed. The data of the questionnaire was processed and analysed by quantitative methods, i. e. using statistical data package SPSS 19, Microsoft Excel and Likert scale. The scale is used in psychology, statistics, marketing, sociology as psychometric scale, with help of which one can record intensity of feelings for a certain object/phenomenon. For research of sociological

nature the size of sample is identified regarding the error of 5 % (K. Kardelis, 2005). The size of the sample was defined by the formula: $n = 1/(\Delta^2 + 1/N)$

where: **n** – a number of cases in the selected group, **N** – general set, Δ – the size of the error. General set is composed of the number of Kaunas inhabitants, namely 286.7 thousand. In order to make the survey representative and reliable (5 % error), 380 respondents' questionnaires were used for the research ($n=1/(0.0025+ 1/286.700)$).

Category data was analysed by chi square (χ^2) criterion. Differences of research findings were considered statistically significant when Asymp. Sig. $p \leq 0.05$. To identify the correlation between range variables, Pearson linear correlation coefficient (rxy) was used, which normally assesses the strength of linear correlation. The scale of correlation coefficient values is as follows: 0 – no correlation found, from 0 to 0.2 – very weak correlation, from 0.2 to 0.5 – weak correlation, from 0.5 to 0.7 – average, from 0.7 to 0.9 – strong, 0.9 to 1 – very strong linear correlation.

When conducting correlation analysis, correlation (r) strength and statistical significance were evaluated. When verifying if the obtained correlation is not coincidental, **p value** was calculated, which shows if correlation is statistically significant. P value obtained from SPSS to evaluate statistical significance of correlation was compared to the value $\alpha=0.05$ (which shows the level of significance). Correlation was considered statistically significant if *p* value calculated by SPSS was <0.05 .

To assess few independent range samples, i. e. by researching the correlation between movement modes and the significance of city's mental view elements as well as the size of perceived visual space according to the observation radius and senses priorities, Kruskal-Wallis test was applied. Kruskal-Wallis criterion is non parameter equivalent of ANOVA one factor disperse analysis. It allows comparing two and more independent sampling groups and identify statistically significant differences if **Asymp.Sig. p-value is < 0.05** . 387 respondents participated in the research of Kaunas city cityscape perception, out of whom 380 filled questionnaires appropriately and they were used for the research. 213 women (56 %) and 167 men (44 %) were surveyed. The smallest respondents' group, i. e. 7.4 % was composed of individuals older than 66 whereas there were 16 % of individuals aged 46-65, 31.6 % of individuals aged 26-45 and 45 % younger than 25. 22.1 % of respondents have higher education degree. 27.6 % have higher non-university degree. 40.6 % have completed secondary education and 9.7 % have finished only vocational school. As far as occupation is concerned, more than a half of respondents are employed (54.5%), students

constituted 37.9 %, 6.8 % are retired, and 0.8 % are unemployed.

By observing cityscape objects, selection of movement modes is important. Going by bus was selected by 41.8 % (57.2 % females and 42.8 % males). 27.4 % prefer going by car (63.5 % females and 36.5 % are males). Travelling on foot is preferred by 26.1 % (49.5 % females and 50.5 % males) and going by bike was chosen by 4.7 % (38.9 % females and 61.1 % males). Comparing movement modes in the central street of Copenhagen [4] and the centre of Kaunas one can notice obvious priorities for means of transport. In Copenhagen people mostly move by bike, even 37 %, whereas in Kaunas only 5 % of individuals choose this mode of movement (currently the system of cycling tracks is being rapidly developed, companies "Bolt" and "CityBee" have started delivering electric scooters and bikes and, therefore, in the future the number of users is going to grow significantly). Approximately the same number choose a bus in cities, that is, 28 and 27 % respectively. In Copenhagen 31 % choose cars while in Kaunas it is 42 % and on foot the values are 4 % and 26 % respectively. By investigating the correlation between movement modes and education statistically significant (assessed by significance level $\alpha=0.05$) weak (**0.2**) Pearson correlation was found among respondents with higher education degree and choosing moving on foot and by bus within Kaunas city.

For the consumer (both local and visiting), cityscape as the whole of nature, history, culture, and traditions in a specific location is perceived via easily identified objects, namely landmarks/dominants (sacred buildings, exceptional architecture, squares, memorial places, monuments), parks, water reservoirs, recurring events, festivals, and local spirit. Having conducted the survey, data comparison with J. Kamičaitytė -Virbašienė and Rūta Ribelytė 2016 [18] research findings was carried out. Objects and factors significant for perception of the city centre landscape and location identity were selected for comparison. Respondents assessed the significance of each object and factor by points from 1 to 5 (5 means very significant). Comparing the data in table 1 (the first provided belongs to J. Kamičaitytė -Virbašienė, and R. Ribelytė, 2016; the second is attributed to V. V. Eidimtienė, the result of the research conducted in 2020), in principle the same results were obtained having assessed the importance of sacral buildings (10 % and 9 %), parks (9 % and 10 %), local spirit, aura (10 % and 8 %), memorial sites (7 % and 10 %). There was little difference in the assessment of events, festivals (13 % and 8 %), sports buildings and complexes (1 % and 4 %), and museums (14 % and 9 %). Rather big differences are observed

TABLE 1

Comparison of assessing factors that determine Kaunas landscape perception and establish local identity, in % [created by the authors]

FACTORS	Parks	Objects of cultural heritage	Sacred buildings	Events, festivals	Squares, pedestrian streets	Sport centres	Shopping places	Memorial places, monuments	Exclusive architecture	Museums	Water reservoirs	Local spirit
2016	9%	19%	10%	13%	11%	1%	0%	7%	5%	14%	1%	10%
2020	11%	11%	9%	8%	6%	4%	6%	10%	11%	9%	7%	8%

comparing the impact of water reservoirs, that is 1 and 7 % respectively. It can be explained by already implemented riverfronts management projects (The project of Santaka park management, 2018, The bank of the Old Pier, 2018, new segments of cycling tracks, Sakura park on Nemunas island as the symbol of friendship between Kaunas and Japan, 2018). The significance of exceptional architecture grew by 6 % as well in 2020. It might have been influenced by newly constructed buildings in the centre, namely large volume dominants (administrative building “Nemuno 3“, 2017, business centres “Happspace Arka“, 2018, “Magnum“ 2019, Piliamiestis quarter – under construction). Squares, alleys, pedestrian streets were assessed less than 5 % if compared to 2016. The result can be related to respondents’ dissatisfaction by repair works, work quality as well as conflict situations because of tree cutting and certain temporary inconveniences. The importance of cultural heritage objects in 2020 was assessed even 8 % less though the number of objects as well as visiting conditions or access have remained unchanged. Shopping places in 2020 were assessed relatively higher and constituted even 6 %. The assessment could be affected by the age of respondents. The group of respondents of 18–25 years old regarded the big supermarkets as popular recreation and meeting points.

By investigating statistically significant correlation between respondents with higher university degree and local identity establishing factors, i. e. sacred buildings, memorial places, and water reservoirs, it was very weak, whereas with parks, cultural heritage, and exclusive architecture it was weak. Between respondents with higher non-university degree and sacred buildings as well as events, memorial places, exclusive architecture and museums very low correlation can be observed. Very low correlation was found between respondents having secondary education and cultural heritage, sacred buildings, and squares while low it was with parks and water reservoirs. Between respondents containing vocational

education very weak correlation with sacred buildings, squares, memorial places, water reservoirs and weak with exceptional architecture and museum assessment was found.

By investigating the factors that determine attractiveness of local objects by the selected criteria, aesthetics was regarded as the most significant (34 %). Historic value (23 %) and being well known (21 %) were equally important. Then there was functionality (15 %) while access was assessed as the least important (7 %). In age groups relation between certain factors and age category was observed, for example, aesthetics was considered as the most important by 67 % of respondents aged 18–25 whereas being well-known was selected by 56 % (26–45 age group) and access seemed more important (52 %) for individuals aged 18-25. Aesthetics criterion was indicated as the most important by respondents with secondary education (56 % of all respondents). Historic value seems more important for those who have higher non-university degree (38 %) while access (41 %) and function (55 %) appealed more for those with secondary education. On the other hand, well-known status is equally important for all groups.

General cityscape is best perceived by observing from the selected special sites (70 %). There are more than 10 observation places in Kaunas city which overlook the city panorama, 4 of them are suitable for the viewing the central part of the city (Fig. 1). The most popular ones are Milikonys hill (69 metres), Aleksotas observation site opened at the beginning of the year (71 m), Kaunas Christ’s Resurrection Church (70 m), Jiesia mound (Napoleon hill) observation site (63.6 m). There are other potential high observation spots in the city (for instance, the upper terrace of artist’s A. Žmuidzinaičius museum patio ~70 m, Neurosurgery clinics surroundings (~66m above the sea level), which overlook views not discovered by photographs and tourists (the data of relief height was taken from <https://www.arcgis.com/>). No correlation with respondents’ age, gender or education was discovered.



Fig. 1. The best observation places of the central part of the city [created by the authors]

TABLE 2

Correlation between selecting visual space size of cityscape observation and modes of movement [created by the authors]

Perspectives of observed objects	Asymp. Sig. p - value			
	On foot	By bike	By bus	By car
Remote, more than 400 m	0.000	0.657	0.000	0.667
Average 150 – 400 m	0.034	0.000	0.079	0.450
Close up to 150 m	0.014	0.000	0.000	0.750

Visibility of separate cityscape objects was assessed according to A. Tauras (1974) proposed classification of perspectives [23] (close perspective – the object is distanced from a spectator 150 m, average perspective – visibility distance ranges from 150 to 400 m, and remote perspective – the distance exceeds 400 m). Separate cityscape elements are best perceived from a small distance (when walking around the object). 64.8 % of respondents selected *close* and 20.5 % chose *average* whereas 14.7 % selected the level of *panoramic* perspective. Correlation with age was observed. This property can be attributed to respondents aged 66 and over, who are most likely to selected the way of observing the object at close (82.1 %). By investigating statistically significant coefficients between respondents with secondary and vocational education, a very low correlation with close observation of an object, i. e. up to 150 m was found. Analysing the relationship between movement modes and visual space size statistically significant correlation was discovered (Table 2). Moving both by bicycle and on foot Kruskal Wallis test shows low up to 150 (**p-value** 0.000<0.05) and average from 150 to 400 m (**p value** 0.000<0.034) distance selection dependence. It confirms the previously raised hypothesis that separate elements of cityscape are best perceived at

a short distance. Travelling by bus, the correlation between a short distance and selecting far perspective (**p-values** 0.000<0.05) was identified. Travelling by such a mode one can reach remote points of cityscape though observation at close still remains important because individuals pay attention to details. No significant correlation between choosing a car and selecting the size of visual space could be found since the observer is free to choose all options.

By observing the cityscape from inside, the impact of five basic elements on perception and orientation was investigated using Likert scale (from 1 to 5, when 5 means very important): paths – streets, tracks; edges – walls, fences, buildings; districts – big city quarters, nodes – the main and local intersection points, and easily identified objects – landmarks. 19.7 % of respondents consider streets and paths as very important for orientation. 54.7 % say it is important; 21.1 % believe it is moderately important and 4.5 % regard them as of little importance. None of the respondents claim that paths are not significant at all. Gender, education, and occupation did not have significant impact on the assessment.

The significance of edges (walls, fences and buildings) within general perception of cityscape was assessed as moderately important (3 points;

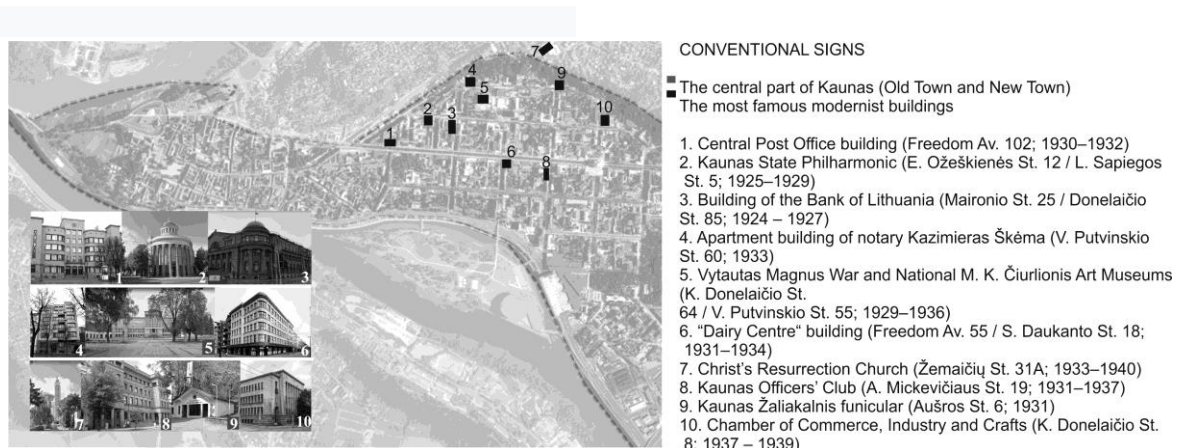


Fig 2. The most famous modernist buildings in the central part of Kaunas [photos are taken from <http://earth.google.com>]

41 %) and less significant (2 points; 31.6 % respondents). 14.5 % indicated that it is absolutely not important (1 point) whereas 9.5 assessed this element by 4 points and 3.4 % marked it as a very important choice (5 points).

The names of Kaunas city elderships/quarters like the Old Town, the New Town, Šančiai, Vilijampolė are well-known in Lithuania and are occasionally used as city synonyms like Brera in Milan (Italy), Montmartre (in French *Montmartre*) in Paris (France), Ciutat Vella in Barcelona (Spain). Such quarters are mostly assessed by 3 (43.4 %), 4 (24.2 %) and 2 (18.7 %) points. 9.5 % of respondents assessed this element by 5 points and 4.2 % regarded it as totally insignificant for general cityscape perception. No statistically significant difference between education, occupation, gender and the assessment of the latter element was recorded.

The main and local intersections as well as the most significant urban and natural nodes, the view of which remains in human memory for a long time such as squares and crossroads were mostly assessed by 2 (39 %) and 3 points (29.4 %). 19 % of respondents assessed nodes by 4 points and regard them significant whereas 2.6 % treat them as very important and 10 % believe they are not important.

City views are mostly perceived and memorized by easily identifiable objects-landmarks (iconic buildings, dominants of spatial structure, groups of exclusive signs). Kaunas is famous for its architecture from interwar period (in 2017 the application of Kaunas modernist architecture "Kaunas 1919-1939: The Capital Inspired by the Modern Movement" was submitted to the preliminary heritage list of the member states of the UNESCO World Heritage Convention) (Fig. 2).

In the Old Town surrounded by unique nature there are numerous Gothics, Renaissance, Baroque style buildings – historic, architecture and cultural monuments: The Church of the Assumption of St. Virgin Mary (or Vytautas the Great

Church) (Aleksoto St. 3, ~1400), St. George the Martyr Church (Papilio St. 9, 1487), Kaunas Castle, 14th century, Kaunas Town Hall (Rotušės Sq. 15, 16th century), Kaunas Cathedral Basilica of the Apostles St. Peter and St. Paul (Vilniaus St. 1, 15th century) and others.

By assessing the importance of well-known landmarks respondents most frequently selected 4 (48.4 %) and 5 points (29 %). 19.5 % chose 3 points and 2 points were selected by 3.1 %. No respondents who believe they were insignificant could be found.

Comparing the average of all five basic elements, the landmark significance was rated the highest (4). Then subsequently paths (3.9), districts (3.2), nodes (2.7) and edges (2.6) could be ranked. By investigating the correlation between different moving modes and mental image elements of the city such as paths, edges, districts, nodes and landmarks, statistically significant differences were found (Table 3). On the basis of the research data one can claim that the correlation between moving on foot and paths (**p-value** 0.001<0.05) as well as moving on foot and district awareness (**p-value** 0.043<0.05) are statistically significant (*Kruskal Wallis* test). According to the obtained results, one can claim that for individuals moving on foot the most important factors for orientation in the city environment are paths and tracks. The data are important and could be used when designing Kaunas city infrastructure projects seeking quality solutions of pedestrian traffic (for those moving on foot, regardless of the age, health condition and movement possibilities).

Analysing the data of the research concerning the correlation between moving by bike and perception of city's mental view elements no statistically significant results were found (*Kruskal Wallis* test).

On the basis of the research data, one can assert that correlation between going by bus and district perception could be observed (**p-value** 0.002<0.05) and it is statistically significant (*Kruskal Wallis* test). The relation is quite clear since while going by bus

TABLE 3
Correlation between perception of city's mental view elements and modes of movement [created by the authors]

Mental view elements	Asymp. Sig. p - value			
	On foot	By bike	By bus	By car
Paths	0.001	0.302	0.390	0.000
Edges	0.092	0.944	0.487	0.392
Districts	0.043	0.908	0.002	0.145
Nodes	0.328	0.154	0.904	0.678
Landmarks	0.676	0.832	0.337	0.580

TABLE 4
Correlation between movement modes and sense priorities [created by the authors]

Sences	Asymp. Sig. p - value			
	On foot	By bike	By bus	By car
Taste	0.006	0.007	0.011	0.109
Smell	0.706	0.163	0.098	0.847
Sight	0.082	0.616	0.049	0.524
Touch	0.527	0.524	0.588	0.202
Hearing	0.971	0.956	0.123	0.070

one does not need to follow turnings of the road and finds direction concerning the next stop from audio information (if the district is selected properly, due to short distances it is convenient to reach the next bus stop on foot).

The research data shows statistically significant correlation between going by car and paths ($0.000 < 0.05$) (*Kruskal Wallis* test). The correlation is very strong and obvious, which was confirmed by respondents who participated in the mental mapping survey and first and foremost drew the main streets of the city centre and Freedom Avenue.

Cityscape is perceived emotionally as well because certain environment elements create positive or negative emotions, which are associative and remain for a long time [20; 21]. The experiences fixed in one's memory are related to sight, taste, smell, touch and hearing senses, and reinforce mental image of cityscape. It is confirmed by 98.7 % of respondents, who assessed the importance of sight by the highest point (5) whereas only 1.3 % chose 4 points, which means that the average score is 5. Tactile senses, i. e. the possibility to touch the object (material and fabric are important) were in the second place – the average point was 3.5. 53.4 % of respondents regarded it as moderately important and 29.5 % treated it as important (4 points). 11.8 % (5 points) considered it as very important and 54.3 % chose 2 points, which means it bears little importance.

Taste and smell senses are closely related. The importance of smell (3.2) and taste (3.2) was assessed equally. The dominating assessment value of taste were 3 (62.1 %) and 4 points (26.3 %). 3.2 % respondents treated taste as very important, i. e. 5

points. 8.2 % indicated little significance (2 points) whereas 0.3 chose it as insignificant at all (1 point). The importance of smell was mostly assessed by 3 (56.6 %) and 4 points (36.8 %). 5.8 % of respondents regarded it as of little significance (2 points) and 0.8 % regarded it as a very significant element (5 points). On the basis of observations [22] smell in cityscape is more important and frequently determines the selection of the route and location. According to J. Stefanou and A. Vasilara, smell is the main element of cityscape, local identity structure and all region character's perception, which should be managed on the scale of city planning.

According to R. M. Schafer's (1993) classification [19] of sounds in cityscape, all types of sounds can be faced (geophony, biophony, anthropony, technophony). On the basis of the research findings, the average score of sound perception within cityscape was 2.6, which meant the fifth place. 7.9 % thought that it is important (4 points) and 0.3 % believed it is very important. By investigating the correlation between different modes of movement and sense priorities (taste, smell, sight, touch, and hearing) statistically significant differences were found (Table 4). According to research data, the observed correlation between moving on foot (**p-value** $0.006 < 0.05$), by bike (**p-value** $0.007 < 0.05$), by bus (**p-value** 0.011) and taste, is statistically significant (*Kruskal Wallis test*). The relationship between certain location and culinary heritage is significant because food is one of the essential elements of touristic experience. Social and cultural significance of food is commonly acknowledged whereas food tourism strategy worldwide is considered as an important tool for regional development since tourists spend on food one third of the incomes devoted for the trip [13].

Travelling by bus (**p-value** $0.049 < 0.05$), the importance of sight is emphasized. Choosing this mode it is most convenient to observe city views that are encountered by following the route.

Cityscape (natural and urbanized) is commonly recognized using all sensory cognitive processes [22] (*receptors and nervous system process signals of the external environment*) and is subsequently followed by perception and mental state. Deeper analysis of Kaunas city psycho-emotional senses could be used for the development of tourism infrastructure by increasing competitiveness of the tourism sector and improving the quality of local inhabitants' services.

Conclusions

1. Elements that establish location identity are important for perception of cityscape. For the majority of respondents (ranking the means of assessment in the respondents' answers

- downwards), they are associated with cultural heritage, parks, exclusive architecture, memorial places, and sacred objects. Dominants of historic architecture are related to symbols of time and power and are important for the development of city's identity. In cityscape they are visually distinguished by height, form, colour while objects for visiting are selected by their historic value, well-known status, and aesthetic view. Their perception is mostly related to the history, culture, political situation of the period and features of the location natural basis, and largely depends on individual's education, personal qualities as well as aesthetic and cultural sophistication.
2. During the research the statement was confirmed that separate elements of cityscape are best perceived at a short distance (64.8 %), whereas general cityscape is best perceived when observing from higher points at the level of remote perspective. The dependence between moving on foot and by bike and a short distance up to 150 m as well as average distance from 150 to 400 m of observing objects could be found. While going by bus the correlation between a short distance and far perspective was identified whereas by choosing a car there was no statistically significant correlation.
 3. Observing cityscape from inside (according to K. Lynch's subdivision of five basic elements within the city area) and comparing the mean of all five basic elements assessment one can rank them by the importance: the highest assessment was chosen for the importance of landmarks (iconic buildings, dominants of spatial structures, exclusive signs). Subsequently there were paths (streets, tracks, other pedestrian routes), districts (large city quarters), urban and natural nodes. Edges had the lowest impact on perception of the environment (walls, fences, buildings). Having investigated the significance correlation of different movement modes and the city's mental view elements, the following links were found: relationship between travelling on foot and perception of paths, travelling on foot and by bus and perception of districts, and travelling by car and perception of roads.
 4. Cityscape is perceived emotionally as well since separate parameters of the environment create positive or negative emotions, which are associative and remain for a long time. Experiences fixed in memory are related to senses of sight, taste, smell, touch and hearing and reinforce the mental image of the city. Sight was assessed as the most important sense in the perception process of cityscape chosen by 98.7 % of respondents. In the second place (the mean was 3.5) tactile senses could be found, i. e. the possibility to touch surrounding objects, feel the material and fabric. Smell was in the third place (mean 3.3) while taste occupied the fourth position (mean assessment 3.2). Hearing was in the last place (mean assessment 2.6). Having investigated the correlation between different movement modes and sense priorities, the correlation between moving on foot and by bike with taste was found whereas while travelling by bus the significance of sight was emphasized.
 5. Psychoemotional senses are very important elements of perceiving local identity and regional character, which could be considered at urban design and planning level. It would contribute to implementation of Kaunas city economic development promotion programme (Strategic plan of 2020–2022), to develop tourism infrastructure, increase competitiveness of a tourism sector and improve the quality of services for local inhabitants.

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Kopsavilkums. Šajā rakstā aplūkotas Kauņas centra pilsētas ainavas uztveres īpatnības un sociāli kulturālie faktori. Pēfīti svarīgi elementi, kas rada unikālu ainavtelpu, identitāti un ir saistīti ar tā laika vēsturi, kultūru, politisko situāciju, atrašanās vietas dabiskā pamata iezīmēm, kā arī indivīda jeb novērotāja izglītību, personiskajām īpašībām, estētisko un kultūras izsmalcinātību. Gadījuma izpētei tika izvēlēta Kauņas pilsētas centra teritorija. To raksturo unikāli dabas, vēstures, kultūras apstākļi un augsts informācijas emocionālais potenciāls. Pēfījuma laikā tika veikta prioritāra klasifikācija par pilsētas ainavas elementu grupu un pieredzējušo psihoemocionālo sajūtu nozīmi. Turklāt tika noteiktas korelācijas starp objekta novērošanas attālumu, novērošanas punktu augstumu, kā arī kustību režīma izvēli un personiskajiem faktoriem. Iegūtie rezultāti izskaidro Kauņas centra pilsētas ainavu uztveres principus.

Landscape intervention in the Hospital for Covid-19 pandemic in Madrid

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Abstract. From Design with Nature of Ian L. McHarg to The Origin of Eukaryotic Cells of Lynn Margulis, the role of the microorganisms in the cycle of life, health, and disease, and in climate change constitutes the life support system of the biosphere. The micro-parklands of the Emergency Hospital in Madrid create a natural system of prefabricated elements following the aim of rapid implementation, isolation, and protection taking as reference the simple integrated system of living microorganisms. These micro-enclosures provide circular areas where patients, visitors, or healthcare professionals can meet in secret places surrounded by trees and shrubs or long green islands where they can walk around. The landscape architecture project has a surface of 7,434 sqm and occupies a plot of 69,791 sqm located in the Hortaleza district of Madrid. Belonging to the previous City of Justice project on the north side of the Institute of Legal Medicine, the plot, which is trapezoidal with a drop of 4,5 meters, is destined for a public hospital constructed in four months during the Covid-19 pandemic. Due to dry climatic conditions, adapted species with low water demand have been selected reducing the risk of allergies or respiratory problems. The topography has been modified to conserve rainwater and direct it to green areas that act as sponges that reduce runoff, store water, remove sediment and pollutants and release it into other ecosystems. There is no separation between soft scape (planting) and hard scape (soil) in the intervention, both are soft and porous and have macro and micro living beings. Following the references of these books, creativity and destruction as real phenomena both have attributes such as fitness and unfitness in the evolutionary way or health and disease. The vital system of living organisms (creativity) and viruses (destruction) has guided the design and distribution of these external areas that intend to prevent infections in the open air, as part of the mutation and adaptation process.

Keywords: Landscape Architecture, Hospitals, Microorganisms, Sustainability, Covid-19

Introduction

In the book Design with Nature, L. McHarg said that there is no generally accepted definition of health, and the medical professions are entirely concerned of disease. But is health only the absence of disease? Initially, there is an attempt to identify the attributes of creation and destruction [7].

On the last day of the year 2019 the world change and in short time, an outbreak became an epidemic and after a pandemic. In the video The Hospital of the Future, OMA presents a tridimensional light structure of a greenhouse with a nurse, showing that it is important to think the hospital in terms of a process, recycling its own waste and producing its components as an organism [8].

The micro-parklands of the Emergencies Hospital in Madrid create a natural system of prefabricated elements following the aim of rapid implementation, isolation, and protection taking as reference the integrated system of living and non-living microorganisms. These micro-enclosures provide circular areas where patients, visitors or healthcare professionals can meet using the site furnishing that will be located following the social distancing, or long green islands where they can walk around.

The aim of the landscape architecture project is to support the hospital in the outdoor areas as part of

the recovery program and to add waiting areas. It is intended to be a part of the machine to heal and to provide relief from the stress and emotional trauma of the Covid-19 hospital environment. Corten steel contours delimit spaces such as outdoor meeting rooms and they can serve to provide isolated enclosures for post-treatment or waiting rooms for the vaccination process. Additionally, the concentration of green infrastructure helps to give continuity with the surrounding parks such as Valdebebas Park and Juan Carlos I Park.

Vision Statement:

Microorganisms_The System of Living

If we assume a man is a benefit and constructive agent in the world, as Ian L. McHarg talked about the viewpoints of man-nature, we could imagine the world as the green celestial fruit, as a great epidermis indeed, but we could consider the green film as cytoplasm and the black, brown, gray centers not as blemishes but as nuclei and plastids-directing, producing, storing and circulating material for the cytoplasm: the creative centers in the world life [7]. At that time, the Gaia hypothesis by James Lovelock and Lynn Margulis states that the planet Earth, including living beings, oceans, rocks, and atmosphere, works like a super-organism that



Fig. 1. Overview render of the north side of the Emergency Hospital landscape [drawing by Cristina Jorge]



Fig. 2. Meeting place of the Vaccination Pavilion [photo by Cristina Jorge]

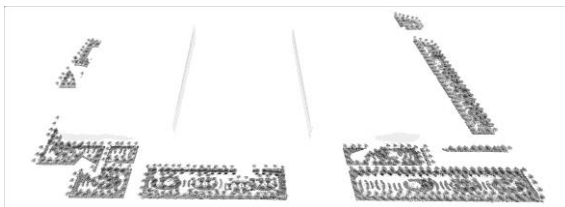


Fig. 3. Overall render of the Emergency Hospital landscape [drawing by Cristina Jorge]

modifies its internal composition dynamically, to assure its own survival [5].

The landscape architecture project has a surface of 7,434 sqm and occupies a plot of 69,781 sqm located in the Hortaleza district of Madrid. This plot, belonging to the previous City of Justice project on the north side of the Institute of Legal Medicine, is destined to a public hospital constructed in 100 days during the Covid-19 pandemic. The plot is trapezoidal and has a drop of 4.5 meters. Due to dry climatic conditions, adapted species with low water demand have been selected reducing the risk of allergies or respiratory problems. The topography has been modified to conserve rainwater and direct it to green areas that act as sponges that reduce runoff, store water, remove sediment and pollutants and release it into other ecosystems.

Open Space Concept: Microorganisms

Microorganisms live in all environments on earth which are occupied by macroscopic organisms, and they are the sole life forms in other environments, such as the deep subsurface and extreme environment. Their immense diversity and varied responses to environmental change make determining their role in the ecosystem challenges. Microorganisms are crucial in regulating climate change. Lynn Margulis supported the theory about symbiosis in evolution as the theory that cell organelles such as mitochondria and chloroplast were once independent bacteria; in other words, the theory that eukaryotic cell is a symbiotic union of primitive prokaryotic cells. She opposed competition-oriented views of evolution, stressing the importance of symbiotic or cooperative relationships between species. Margulis also postulated that eukaryotic cilia were also originally spirochetes and that cytoplasm evolved from a symbiotic relationship between eubacteria and archaeobacteria. She articulates a five-kingdom system of classifying life on earth-animals, plants, bacteria (prokaryotes) fungi and protocists (most unicellular organisms and multicellular algae) [6].

The system depends upon the sun, the net production of photosynthesis after respiration, upon the water and upon the cycling and recycling of the materials in the system of decomposers. The process requires that the substances of waste, the output of one creature, are the imports or inputs to the others. The oxygen wastes of the plant were input to the man, the carbon dioxide of the man input to the plant; the substance of the plant input to the man, the wastes of the man input to the plant; the wastes of man and plant input to the decomposers; the waste of these input to the plant: and the water went round and round and round. This is the way the world works in essential terms of Design with Nature [7].

Drought tolerant plants, or native plants, had been used in the intervention which require less water than a lawn. They are more adapted to the environment and are also born with natural defenses meaning less fertilizers and fewer pesticides are required for them to thrive.

The wild species of the building plot had been altered by human activity, so there are no species included in the Catalogue of Endangered Species. There were monoecious trees which are less allergenic than others. This is because not all pollen is created equal. The worst pollen for allergy sufferers is the type that has a fine texture. Coarser pollen tends to stick closer to home, rather than traveling around and launching attacks on the poor allergy-sufferer.

Following the classification system of microorganisms, such as five major kingdoms have been described and include prokaryote (archaea and bacteria), protocista (most unicellular organisms and algae), fungi, plantae, and earth-animals, the soft

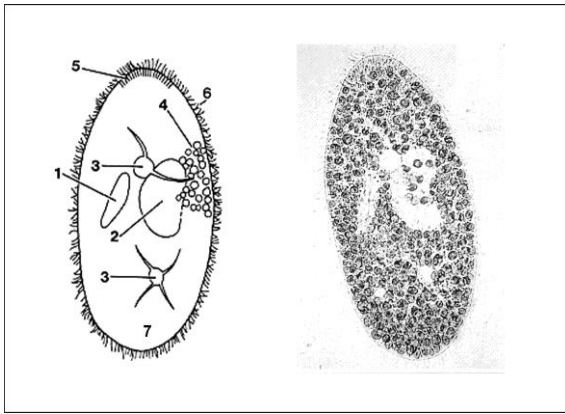


Fig. 4. Microorganisms' Elements: 1. Cytopharinge_ 2. Macronucleus 3. Contractile Vacuoles_ 4. Food Vacuoles_ 5. Trichocyst_ 6. Cilia [material from Cristina Jorge private archive]

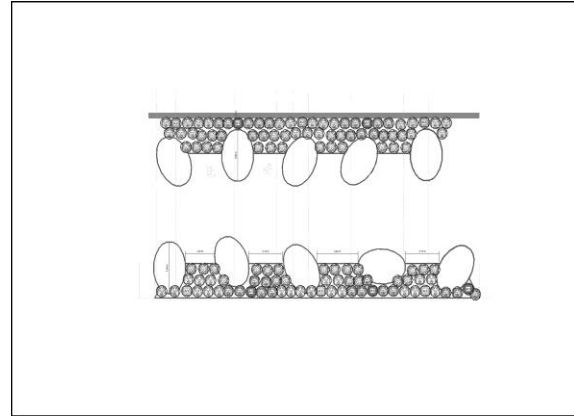


Fig. 6. Diagram of the Protection system_Cell wall of the Emergency Hospital landscape in Madrid [drawing by Cristina Jorge]

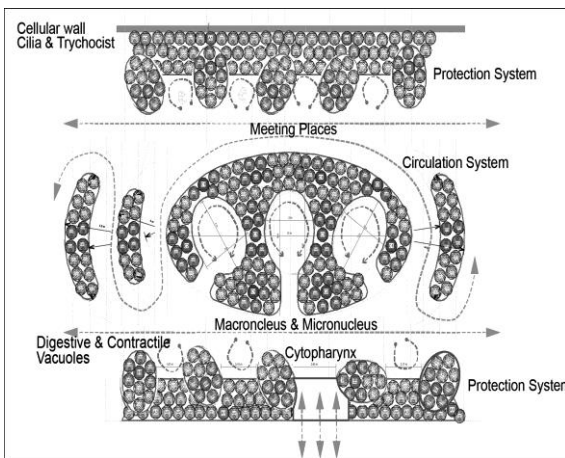


Fig. 5. Diagram of landscape elements [drawing by Cristina Jorge]



Fig. 7. Image of the Protection system_Cell wall of the Emergency Hospital landscape in Madrid [photo by Cristina Jorge]

planning palette has been developed. A kingdom is further split into phylum or division, class, order, family, genus, and species, which is the smallest group [2].

The ways of approaching the living system of the microorganisms use to design the landscape intervention are synthesized in: Cell wall (cilia and trichocyte), Nuclei (macro-nucleo and micro-nucleo) and Vacuoles/Plastids (contractive & food vacuoles).

These are ways of approaching the living system of the microorganisms:

Protection system or Cell wall

The green bands parallel to the three pavilions of the hospital complex lead to the closing of the landscape intervention where the presence of rows of trees, aromatic shrubs, and colorful groundcovers make up a highly sensitive natural environment. The scheme of clean roads parallel to the street that joins the three pavilions follows the straight lines that characterize the hospital corridors. The parallel green bands to the main road meet the objective of border and protection taking as reference the planting palette of the Sierra Norte layer.

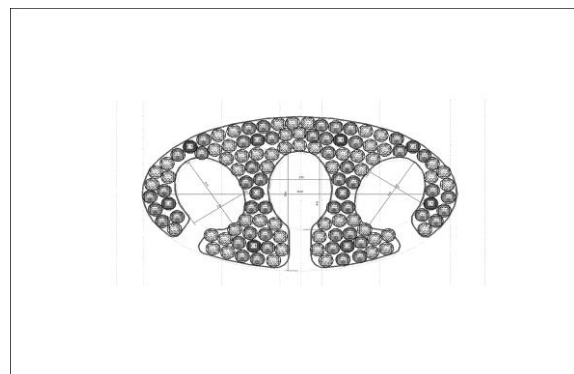


Fig. 8. Diagram of the Meeting place_Nuclei DNA of the Emergency Hospital landscape in Madrid [drawing by Cristina Jorge]

Cell wall: Cilia & Trichocyst

The entire body microorganism is covered with cilia appearing in rows, approximately longitudinally disposed, over its surface. Trichocyst as an organelle with shape like harpoon is a structure in the cortex of certain ciliate and flagellate protozoans consisting of a cavity and long, thin threads that can be ejected in response to certain stimuli [10].



Fig. 9. Image of the Meeting point_Nuclei DNA of the Emergency Hospital landscape in Madrid [photo by Cristina Jorge]

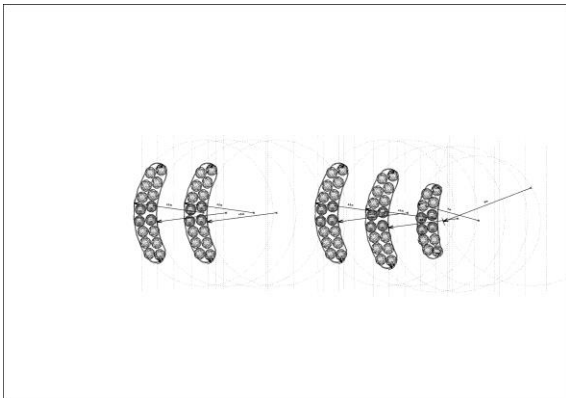


Fig. 10. Diagram of the Circulation system_Vacuoles of the Emergency Hospital landscape in Madrid [drawing by Cristina Jorge]



Fig. 11. Image of the Circulation system_Vacuoles of the Emergency Hospital landscape in Madrid [photo by Cristina Jorge]

Meeting place or Nuclei DNA

Surrounded by fruit trees, aromatic shrubs, and groundcovers that do not cause respiratory problems or allergies, family units can be brought together into these outdoor waiting rooms that will house benches, chairs, and support tables in the future. These micro-spaces are opened to multiple uses of all ages such as playing, teleworking, and resting. The soft landscape takes as reference the planting palette of the Estepa Sur layer.

Macronuclei & Micronuclei

The nuclear complex is peculiar in that it is not differentiated into micro-and macro-nuclei but are very similar to the nucleus of *Ameba proteus*. The macronuclei control metabolic and developmental functions; the micronuclei are necessary for reproduction. The nucleus does not occupy a fixed position but is moved around by the streaming of the protoplasm [11].

Circulation system or Vacuoles/Plastids

The landscape design made of elliptical and longitudinal green areas leaves controlled enclosures between them and opened views over parks around. These "parentheses" enclose the core areas and lead to safe walkways. The recovery of Covid-19 patients can leave side effects such as the formation of thrombosis in the leg veins by increasing blood flow. Doctors recommend daily exercise and long walks during recovery. These green areas take as reference the planting palette of the Vega Campiña layer.

Food Vacuoles & Contractile Vacuoles / Plastids

Food vacuoles are numerous and vary in number and color with the amount of food ingested and the stage of digestion of this food. Just after ingestion of food the vacuoles are brown or dark green due to the color of the *Oscilkitoria*, but as digestion proceeds, they are changed to a shade of purple, then pink, and finally faint straw color. The contractile vacuole is stationary and is the point toward which the streaming of the protoplasm is directed. As metabolism ensues minute vacuoles of clear fluid are formed throughout the protoplasm. With the streaming of the protoplasm, these vacuoles are brought into close contact with the point at which the contractile vacuole is formed. As storage sacs for solid or liquid contents, they are small in animal cell (vacuoles) and large in plant cell (plastids) [10].

Microorganisms:

Soil_Earth Oxigenation_Hardscape Palette

To talk about soil, humus, matter it is important to pay attention how parasites, pathogens and age make incursions within their host while environment and predators attack it from without. The agents of disease proceed towards death as a process, in which the carrion eaters, scavengers, insects and their larvae, worms, fungi and bacteria reduce the matter into reusable forms. Decomposers are described by McHargh as the return stroke of matter in the cycles of life. The water acts on land surfaces and through erosion and sedimentation changes their surfaces towards equilibrium, a condition of repose in which matter moves from a condition of greater to lesser randomness. In terms of energy, while entropy or degraded energy in any system must increase, in life systems and the orderings that they accomplish, there is evidence, not of degradation, but upgrading, the countertendency [7].



Fig. 12. Site photo of previous state of the Emergency Hospital in Madrid [material from Cristina Jorge archive]

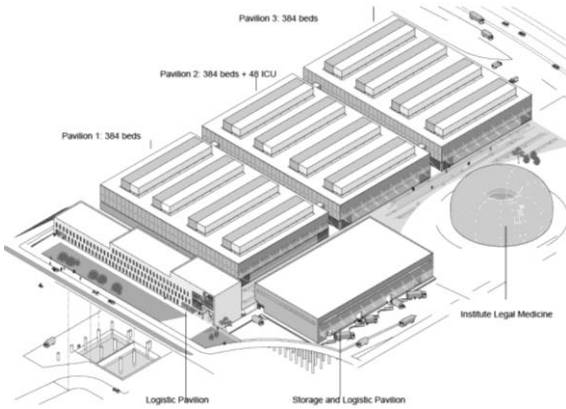


Fig. 13. Organigram of the Emergency Hospital in Madrid [material from Cristina Jorge archive]

Porous base materials or Cytoplasm

Compacted red soil acts as a granular fluid. The hardscape is really porous and soft and it has the same living beings as in the planting softscape. The pavements are porous using materials such as limestone, crushed red granite, quartz, feldspar, mica, and they are compacted following the contours of the terrain. On the underground galleries belonging to the previous unfinished City of Justice project, a part of the landscape intervention has required additional layers such as waterproofing, vapor barriers, drainage, and other elements typical of green roofs. To guarantee the compactness of the discharges, it has been necessary to carry out cleaning operations to remove the disintegrated and non-compacted soils.

Context Analysis

There is the possibility to create a creative-fit-healthy environment, so it would seem important to identify the environment of health and pathology. Promoted by McHarg and his students in the research about city of Philadelphia, it was relevant to investigate the factors of the social and physical environment that are identifying with these polarities and with the intervening phases [7].

The Emergency Hospital in Madrid with a total of 80,000 sqm has six infrastructures: three hospitalization pavilions with 10,500 sqm each, with more than 1,000 hospital beds, and 48 ICU beds; a storage and logistic pavilion where medical supply will be stored for all hospitals in the region; a multipurpose sanitary building, which will house the Summa 112 Contingency Center; and finally, 6,000 sqm of underground galleries with the central of air conditioning waste management and high voltage.

The landscape interventions are supported by the measures taken to ensure the proper functioning of the Emergency Hospital. The new Hospital in Madrid was built in response to the first wave of Covid-19 pandemic in Spain and it was promoted by the Dirección General de Infraestructuras of the Consejería de Sanidad de la Comunidad de Madrid. The original intention was help alleviate pressure on other public hospitals, focussing on the Covid-19, but there were political conflicts during the construction.

The purpose of these therapeutic gardens is to provide relief from the stress and the emotional trauma of the Covid-19 hospital environment. The corten steel edging pieces delimit spaces as open-air rooms that can be used after the treatment, can serve to remain an island or to join family members and wait medical reports.

The specifications of the Ordinance for the use of Municipal Green Zones have been considered. The definition of urban furniture, the necessary elements of the transport network and the infrastructure services have been adjusted to the Municipal Police Ordinance of the Urbanization.

Design Opportunities

New Topography

The site, at Doctor Fernandez Iparaguirre Avenue, is trapezoidal, presents an evenness of 4,5 meters and has a surface of 69.791 sqm. Topography has been modified to direct the water into the green areas and to function as a sponge in absorbing rainwater and releases it into other ecosystems. The design follows the natural contours of the land with prefabricated steel contours which helps to adapt the landscape intervention at the urgency of those moments and helps to adopt future adaptations and mutations. The terrain presents to the north a noticeable unevenness between the road parallel to the three pavilions of the emergency hospital towards the fenced perimeter.

Green roofs over underground galleries

Over the previous subterranean gallery, the part of the landscape intervention has required additional layers such as thermal insulation, drainage, and other elements taken from green roof interventions.



Fig. 14. Topography movements in the construction phase of the Emergency Hospital landscape [photo by Cristina Jorge]



Fig. 15. Greenroof movements in the construction phase of the Emergency Hospital landscape [photo by Cristina Jorge]

On the surface, there is a level of anthropic fillings formed by crumb sands and coarse sands. Fill thicknesses typically range from 0.50 to 7.00 m, depending on the zones. The greatest thicknesses are found next to the underground gallery that was built as part of the ill-fated City of Justice campus. These excavations were partially filled in at some points, probably compacting the ground, until the work stopped, and later they were filled with soils probably uncompacted to cover or hide the enormous concrete gallery. This gallery connects underground the Institute of Legal Medicine with the 6,800 sqm of central facilities (boilers, air conditioning, supplies, transformers). There will be up to 5 km of fiber optics, central equipment to allow network connectivity and 300 Wi-Fi access points.

Compactness Alkaline soil

The penetration test carried out at various points indicate the presence of medium to low compactness materials that shows they are not spilled materials, but materials that have undergone certain compactness, either by the machinery or by their own weight. The age of these fillings exceeds the eleven years of climatic agents, especially rainfall. To guarantee the compactness of landfills, it has been necessary to execute a series of clean-ups to remove the spilled and non-compacted soils. The grading level is +642. It has been necessary to raise



Fig. 16. The main view of northside of the Emergency Hospital landscape_Dry climate [photo by Cristina Jorge]



Fig. 17. The main view of northside of the Emergency Hospital landscape_Prevailing Winds [photo by Cristina Jorge]

some areas and to fill others. Additionally, certain areas were cleaned by digging below the general level of grading. These soils were compacted to at least 95 % of the maximum density of the reference Modified Proctor in layers of 25 cm, by using self-propelled vibratory roller after wetting and spreading the layers. The samples extracted at a depth of 0.8m are: PH (S1 / 0,8m) = 7,9. As the PH sample is superior to 7, the soil is alkaline. The level of alkalinity in human blood determined by CO₂ (as in the ocean) shows an equally small tolerance.

Microclimate Considerations

It is possible to see the ordering of physical processes accomplished by precipitation, erosion and sedimentation, volcanism and uplifting, lighting and evaporation, all reducing the randomness of matter essential to this ordering; but overwhelmingly the plant is seen to be the basic agent for the ordering linked with entropy and creation. Negentropy is the term that McHarg use to describe the sum of all life and all time as a tide of ordering moving differentially against the force of entropy, evolving from the order of the nonliving into life, from simple to complex life, from uniformity to diversity, from a small number to an infinitude of species, aspiring to dynamic equilibrium [7].

Beyond descriptions of abundance of micro-organisms in the atmosphere, is it relevant an understanding of their dynamics in terms of both



Fig. 18. The main view of northside of the Emergency Hospital landscape_Rainfall [photo by Cristina Jorge]



Fig. 19. The main view of northside of the Emergency Hospital landscape_Snow [photo by Cristina Jorge]

biological and physico-chemical properties and of the transport processes by air at different scales as riders of atmospheric transport systems. Airborne microorganisms, mostly bacteria, are normally dispersed into the air, which can have both beneficial and detrimental effects. Climate change directly and indirectly influences microbial communities and their functions through several interrelated factors, such as temperature, precipitation, soil properties and plant input [3].

Dry climate. The studies of trees, shrubs, and herbaceous species have been carried out according to sunshine and UV index of 2,769 hours per year. The predominance of two types of strategies is fundamentally directed to withstand unfavorable summer conditions: sclerophyllia, which manifests itself in many woody plant species, and the annual cycle-terophytes-, dominant among the species pasturelands.

Prevailing winds. The dominant winds that are from the southwest have the pavilions of the hospital built to protect the green infrastructure. In general, winds from the southwest by night are more frequent than those from the northeast at night. In winter, the winds from the northeast are dominant both day and night where the industrial building is located as wind barrier. In the hospital, the air flow is conducted by a particular air conditioning circuit the new air is expelled through the clean area and collect through the dirty area.

Rainfall. Climate, above all precipitation, is one of the most limiting factors, not only because of its inherent characteristics but also because of its influence on the processes of edaphogenesis and productivity. In addition, precipitation is subject to great variability, not only between the different seasons of the year but between successive years. The approximate rainfall is 450 mm, the average annual temperature is 13.7 ° C and the average relative humidity 57 % in Madrid.

Snow. The heaviest snowfall in five decades has blanketed Madrid over in January 2021, after a giant storm hit southern and central Spain, causing some damage to newly planted trees and shrubs. Linking with microscale analysis, the microscope can reveal the striking forms of snowflake crystals. The electron micrograph shows the modular geometry of the atoms, the crystalline form of giant molecules.

Soft Planting Palette with non-allergic species

It is a building plot where the open areas were occupied by wild species and altered by human activity. There are no species included in the Catalogue of Endangered Species. Some monoecious trees are less allergenic than others. This is because not all pollen is created equal. The worst pollen for allergy sufferers is the type that has a fine texture. Coarser pollen tends to stick closer to home, rather than traveling around and launching attacks on the poor allergy-sufferer.

Drought tolerant plants, or native plants, requires less water than a lawn. They are more adapted to the environment and are also born with natural defenses meaning less fertilizers and fewer pesticides are required for them to thrive.

Following the classification system of microorganisms, such as five major kingdoms have been described and include prokaryote (e.g. archaea and bacteria), protocista (e.g. protozoa and algae), fungi, plantae, and animalia, the soft planning palette has been developed. A kingdom is further split into phylum or division, class, order, family, genus, and species, which is the smallest group.

Microorganisms:

Mutation & Adaptation Phases and Restrictions

As conditioning factors, we can say that all food, all fossil fuels, fibres, all atmospheric oxygen, the stabilization of the earth's surface and its terrestrial water systems, the melioration of climate and microclimate have been accomplished by the plant: all animals and thus all men were plant parasites. It is established this realization of dependence as a crushing blow of anthropocentrism [7].

Unfortunately, community leaders and politicians rarely look beyond the immediate response and future. Due to the urgency in the inauguration, the economic restrictions, and the extra cost of the Emergency Hospital in Madrid with respect to the initial budget, some parts of the landscape

TABLE 1
Soft landscape Palette: Sierra Norte Layer
[created by Cristina Jorge]

Type A_ Vegetation_ Sierra Norte layer
Classe 1: Trees
<ul style="list-style-type: none"> ▪ Order A1_ Hackberry (<i>Celtis australis</i>) ▪ Order A2_ Gall Oak (<i>Quercus faginea</i>). ▪ Order A3_ Oak Melojo (<i>Quercus Pyrenaica</i>)
Classe 2: Shurbs
<ul style="list-style-type: none"> ▪ Order Aa1_ Myrtle (<i>Myrtus communis</i>) ▪ Order Aa2_ White rockrose (<i>Cistus monspeliensis</i>) ▪ Order Aa3_ Genista (<i>Genista hispánica</i>)
Classe 3: Groundcovers
<ul style="list-style-type: none"> ▪ Order Ah1_ Cotoneaster (<i>Cotoneaster Coral Beauty</i>) ▪ Order Ah2_ Rosemary (<i>Rosmarinus officialis</i>) ▪ Order Ah3_ Thyme (<i>Thymus vulgaris</i>)

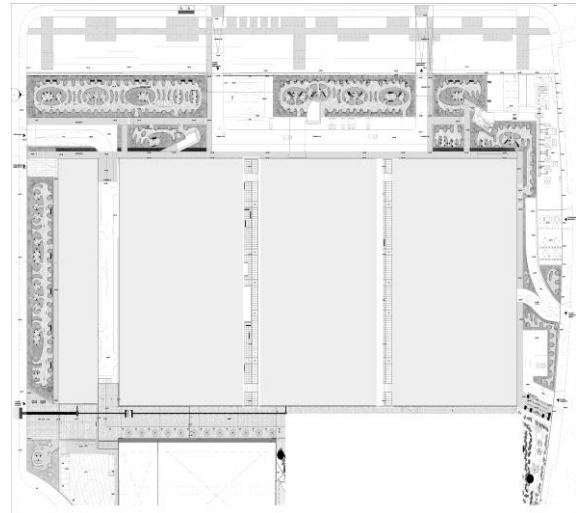


Fig. 20. Key plan Phase 1
of the Emergency Hospital landscape in Madrid
[drawing by Cristina Jorge]

TABLE 2
Soft landscape Palette: Vega Campaña Layer
[created by Cristina Jorge]

Type B_ Vegetation_ Vega Campaña layer
Classe 1: Trees
<ul style="list-style-type: none"> ▪ Order B1_ Carob tree (<i>Ceratonia siliqua</i>) ▪ Order B2_ Judas tree (<i>Cercis siliquastrum</i>) ▪ Order B3_ Crape myrtle (<i>Lagerstromia indica</i>)
Classe 2: Shurbs
<ul style="list-style-type: none"> ▪ Order Ba1_ Laurel (<i>Laurus nobilis</i>) ▪ Order Ba2_ Viburnum (<i>Viburnum tinus</i>) ▪ Order Ba3_ Mastic (<i>Pistacea lenticus</i>)
Classe 3: Groundcovers
<ul style="list-style-type: none"> ▪ Order Bh1_ Teucrium (<i>Teucrium fruticans</i>) ▪ Order Bh2_ Salix (<i>Salix salvifolia</i>) ▪ Order Bh3_ Erigeon (<i>Erigeon karvinskineon</i>)



Fig. 21. Key plan Phase 1
of the Emergency Hospital landscape in Madrid
[drawing by Cristina Jorge]

TABLE 3
Soft landscape Palette: Estepa Sur layer
[created by Cristina Jorge]

Type C_ Vegetation_ Estepa Sur layer
Classe 1: Trees
<ul style="list-style-type: none"> ▪ Order C1_ Wild cherry (<i>Prunus avium</i>) ▪ Order C2_ Japonese plum (<i>Prunus cerasifera</i>) ▪ Order C3_ Strawberry tree (<i>Arbutus unedo</i>)
Classe 2: Shurbs
<ul style="list-style-type: none"> ▪ Order Ca1_ Hawthorn (<i>Crataegus monogyna</i>) ▪ Order Ca2_ Phyllyrea (<i>Phillyrea angustifolia</i>) ▪ Order Ca3_ Blackthorn (<i>Prunus spinosa</i>)
Classe 3: Groundcovers
<ul style="list-style-type: none"> ▪ Order Ch1_ Jasmine (<i>Jasminum fruticans</i>) ▪ Order Ch2_ English Lavander (<i>Lavandula angustifolia</i>) ▪ Order Ch3_ Honeysuckle (<i>Lonicera implexa</i>)

architecture project have not yet been built and others have had to be modified and reduced. For this reason, as part of the adaptation and mutation process, there is a key plan (phase 1) that may be completed when the pandemic has finished, and the times relax and a key plan (phase 2) that were modified to comply with the schedules, deadlines and, new budget available which meant a notable reduction in numerous budget

chapters. The hospital and its landscape of the future will be in constant flux, like a theater, transforming its space to the event. In the OMA office work research, they ask whether the hospital using its waste as resource, could it rebuild itself perpetually. The hospital of the future will be self-sufficient, like a green house or a microorganism, producing its own crop or its own way of feeding [4].

Conclusions

In the last chapter of Design with Nature, "The City: Health and Pathology", there is a synthesis about the importance of identifying the environments of health and pathology. McHarg and a group of students were concentrated on the presence of health and disease as indicators of creativity and fitness, destruction, and unfitness in the city of Philadelphia. Summarizing that at that moment (1969), it seemed clear that crowding, social pressure, and pathology did correlate sufficiently to justify more serious investigation. The central proposition had been that creativity and destruction are real phenomena,

that both have attributes, that fitness and unfitness-in the evolutionary way-are expressions of these, as are health and disease [7].

The creativity is represented by how micro-organisms are beneficial in producing oxygen, decomposing organic material, providing nutrients for plants, and maintaining human health, but some that represent the destruction can be pathogenic and cause disease in plants and humans.

The destruction is focused on viruses which are noncellular entities that consist of a nucleic acid core (DNA or RNA) surrounded by a protein coat. They often infest prokaryotic and eukaryotic cells causing diseases. Although viruses are classified as microorganisms, they are not considered living organisms. Viruses cannot reproduce outside a host cell and cannot metabolize on their own.

Beyond the living and non-living system of primitive organisms that have guided the design and distribution of these external areas that try to prevent possible infections, the eternal materials of the finite earth, increased by the residues of long dead encapsulations of ancient sunlight creatures, move again and again through plants, animals and wastes, constantly recycled by decomposers.

Algae and plant cells have a second set of bodies that they use to carry out photosynthesis. Known as chloroplasts, they capture incoming sunlight energy. The energy drives biochemical reactions including the combination of water and carbon dioxide to make organic matter. Chloroplasts, like mitochondria, bear a striking resemblance to bacteria. Scientists became convinced that chloroplasts, like mitochondria, evolved from symbiotic bacteria – specifically, that they descended from cyanobacteria, the light-harnessing small organisms that abound in oceans and fresh water. It had been suggested in the late 19th century when similarities between mitochondria and bacteria were noted, but largely dismissed until it was

revived and championed by Lynn Margulis in the 1960s and 1970s; Margulis was able to make use of new evidence that such organelles had their own DNA that was inherited independently from that in the cell's nuclei [6].

The science of the relations of organisms and the environment in the quest for survival, success and fulfillment offers an invaluable insight. It shows the way for the man who would be the enzyme of the biosphere that acts as biological catalysts, enhancing the creative fit of man-environment, realizing man's design with nature.

In the last picture of the video *The Hospital of the Future*, we can see a small building in a forest, because we need to think about the hospital, not in terms of a finite product, but in terms of a process and not as a building, but in terms of an organism. The hospital of the future will give way to the machine, liberating its staff from routine tasks and leaving precision in hands of accurate devices. Finally, OMA ask about the possibility of having a hospital more human in the future [8].

Emergency situations caused by natural disasters, pandemics or war conflicts have the potential to speed adaptation processes to new landscape interventions and innovative building systems through topographic movements, new materials, and light structural prototypes. From the astronaut as instructor whose aspiration is survival, the purpose is to create a self-sustaining ecosystem, whose only import is sunlight, whose only export is heat, sufficient to sustain a man for a certain period of time. From *Dersu Uzala's* film (Akira Kurosawa, 1976) [1] to *The Revenant's* film (Alejandro González Iñárritu, 2015) [9] we can see the need for a more targeted approach to a landscape architecture of survival as the main character of one of these films said: "As long as you can still grab a breath, you fight".

Credits

Project: Emergency Hospital Landscape in Madrid; Location: Madrid, Spain; Designer Landscape architecture project: Cristina Jorge_Cjcpaisaje; Architecture: Chile15 arquitectos; Commissioned by: Servicio de Salud de la Comunidad de Madrid; Surface: 7.434 m²; Design: 2020; Realization: 2020

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Kopsavilkums. Madrides ārkārtas slimnīcas mikro parki rada dabisku saliekamo elementu sistēmu, kuras mērķis ir ātra ieviešana, izolācija un aizsardzība, atsaucoties uz vienkāršu integrētu dzīvo mikroorganismu sistēmu. Aprakstītās mikro iekārtas nodrošina apļveida laukumus, kur pacienti, apmeklētāji vai veselības aprūpes speciālisti var satīties slepenās vietās, ko ieskauj koki un krūmi, vai garas zaļas salas, kur viņi var staigāt. Ainavu arhitektūras projekta platība ir 7 434 m², un tas aizņem 69 791 m² lielu zemes gabalu, kas atrodas Madrides Hortalezas (*Hortaleza*) rajonā. Sauso klimatisko apstākļu dēļ ir izvēlētas pielāgotas sugas ar zemu ūdens patēriņu, samazinot alerģiju vai elpošanas problēmu risku.

Phenomenon of Urban Agriculture and Its Role in Shaping Sustainable Cities

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Abstract. The rapid growth and development of the world have led to significant changes in the expansion of urban sprawl, land distribution, and the general functioning model of modern cities. The problems connected to ecology, economy, human physical and mental well-being become more urgent with every day under the influence of arising deficiency of open green spaces, nutritional security, and sustainable financial models for small-scale businesses within the cities; and not only affect regular citizens but also general tendencies of urban and landscape planning that are supposed to deal with those issues. One of the tools aimed at combating them for the past decades has been an increasingly popular urban agriculture, particularly chosen as a studying object of interest for this publication. The following paper represents complex research conducted in an integrated manner by reviewing the overall phenomenon of urban agriculture and its pioneering practices; determining the key components of their successful functioning and positive ways of affecting surroundings; and consequently forming the list of concluding recommendations for planning and management of such structures. As the main methods of research, the selective case study, describing principal features of such initiatives, and relevant literature analysis for the fundamental information gathering were applied by the author. The results of the research were composed into the summarizing table highlighting core data and supporting developed conclusion based on examination and designing suggestion for interested parties.

Keywords: urban agriculture, sustainable urban development, sustainable land use, resilient landscape design

Introduction

The ways of urban planning have been constantly changing under the influence of emerging needs of societies, economies, and politics. In the age of global development and growth of urban surroundings, the issue of inefficient land management within cities has started to resonate like never before, fuelled by attended problems with the environment, lack of community resources, and health concerns. If previously the main accent of urban development was centred on producing quantity, now the recent shift of human perception drives it towards quality, creating new sustainable tendencies of shaping our cities. Among rising innovative approaches over the past decade, the phenomenon of urban agriculture has been the one gaining the most attention due to the comprehensiveness of its methods, and wide range of exposure.

Urban Agriculture

Urban agriculture (UA) is defined as any kind of crop cultivation and production realised in domestic or public settings in urban or peri-urban areas [1]. Generally, it incorporates vegetable and fruit tree cultivation, but sometimes might be associated with the cultivation of medicinal, herbal, or ornamental plants [2]. In some cases, UA could be connected even with small-scale animal raising (e.g. various poultry breeds), apiculture (beekeeping), and aquaculture practices (a combination of mutually beneficial growing of fish and plant culture) [3].

Historically, UA has been present in the infrastructure of cities in a variety of forms since the dawn of time. As an instance, the Inca citadel Machu Picchu, dated the 15th century, had facilities for

rainwater management, and specifically designed growing beds that captured a higher percentage of the sunlight [4]. Years later, it was reintroduced to Europe as a response to the poverty and food insecurity caused by economic crises and protracted wars. At the beginning of the 19th century, Germany came up with the idea of allotment gardens, which fed millions of people during depression times [5]. Almost the century after, the USA had developed a similar strategy establishing Victory gardens concept that supported many American families with the provision during the WWI and WWII [6]. Suchwise, UA has continued to arise in different parts of the world to date responding to the needs of the communities, whether they connected to political, economic, social, or environmental contexts.

Referring to the context of UA initiatives' appearance, their ways of realisation could be identified in the following types:

- Community gardens – self-assembled initiatives with a 'bottom-up' approach organized as a response to the social or economic issues inside the community [7].
- Allotment gardens – individual pieces of urban or suburban land officially provided for leasing by the government or privately owned by individuals for non-commercial cultivation of food and recreation purposes [8].
- Community farms – a professional type of UA initiatives based on the engaging community in small-scale food production operated and run by experienced farmers. In general, all the main decisions in regard to farm management, choice of

growing crops, and harvesting are taken by superior professionals while locals are welcomed to volunteer with routine tasks [9].

- Institutional farms and gardens – ones that belong to particular institutions such as schools, hospitals, or private companies. Their gardening practices are not connected to the food production itself, rather to its indirect benefits [10].
- Commercial urban farms – fully commercial subtype of UA established with the goal of maximizing the profitability of the crop production grown in the urban settings but with the emphasis on sustainable farming practices and sensitive approach to local ecology [11].

In practical terms, UA activities can be implemented by means of diverse techniques starting from classic direct open-soil gardening and ending with, high-tech techniques, such as vertical farming, aero- and aquaponics [12]. Overall, UA could take forms of raised bed/container gardening, shipping container farming, rooftop cultivation, greenhouse and tunnel growing, edible walls, or landscapes [13].

Benefits of urban agriculture. As it was defined before, UA has various ways of beneficial affecting of surroundings. Due to the constant mutual influence between UA and the urban environment itself, their relationship plays a crucial role in the formation of socio-economic conditions (food security, the health of inhabitants, level of poverty), contingent conditions (quality standards, land market prices, policies), and resource distribution (water, land, labour, organic wastes) within the cities [14].

Food and nutritional security. UA contributes to the food and nutritional security of cities, making food production more available, accessible, and stable for all social layers of the community [15], thereby providing them with all essential food components in nutritional terms [16]. As an instance, in a study conducted with the use of multivariate analysis devoted to the assessment of the impact the UA has on the dietary adequacy of people involved in it, the results have shown that through means of urban cultivation, people received access to more nutritious, fresh, and quality products which in a turn improved their diets [17]. This, as well, allowed people with low income to considerably save a greater part of their money previously spent on food. Consequently, reduction of expenditure caused a general increase in income and led to poverty alleviation [18]. Likewise, food production within cities results in prolonging of the growing seasons due to microclimatic differences with the rural areas, as well as more accessible use of resources like water and electricity, availability of labour, and bigger percentage of non-flooded areas, what brings an enormous advantage in terms of longer and easier access to the fresh crops [19]. Another benefit in relation to food access is the possibility to shorten the number of intermediaries between producers and consumers during the supply

process what for its part also cuts time spent on those operations and helps to deliver products faster [18].

Economy. As it was previously mentioned, some types of UA initiatives function for commercial purposes only, what helps urban communities to create a disposable source of income and contribute to the development of local small-scale businesses [20]. UA creates job opportunities and triggers the growth of the economic activities related to farming (e.g. food processing, packaging, marketing, etc.), which in a turn provide the community with the working places [21]. It allows people to benefit with financial savings by means of growing their own food, and if the consumer isn't a grower, then through buying produce cultivated in the urban environments and supporting local communities, they still pay less as the price of these products is basically lower due to the absence of extra transportation costs occurring in cases where food is delivered from further locations [22]. In this way, micro and macroeconomics of the localities benefit on both levels, forming brand new individual consumer behaviour and tendencies of urban development.

Environmental impact. In terms of the larger-scale impact of UA, it is impossible to gloss over its general positive effect on the environment. Various kinds of pollution originated inside the cities, constitute a threat to public health and ecological balance as a whole. Cities are major emitters of greenhouse gas and produce over 70% of global CO₂ emissions in urban areas [23]. Besides that, existing waste management strategies for cities aren't sufficient enough and don't correspond to the actual challenges and needs of urban environments [24]. Conversely, in response to that, UA can propose the facilitation of sustainable ways for an alternative governing of ecological constituents of city spaces. Organic waste can be turned into compost furtherly used at the gardens for increasing production of fresh produce [25], sewage can be utilized for irrigation purposes and organic solid waste for fertilizing, meanwhile inorganic wastes (e.g. plastic bottles, tanks, storage boxes) will perfectly suit as an upcycled growing units for smaller crops [26]. The increase of green spaces within the city positively influences urban microclimate and strengthen its biodiversity. Thus, trees and herbaceous plants are able to reduce dust, and the percentage of negative compounds influencing air pollution, such as nitrogen dioxide (NO₂) [27]. Therefore, UA advances the cutback of the urban ecological impact by both sustainable waste management [28], and a decrease in emissions produced through transporting, storing, and packaging of goods, since the growing areas are located in the nearest areas to the final consumer [2].

Social aspects. On top of all, UA serves an important role in community-strengthening and integrating people with disadvantages or vulnerable social groups affected by stigmatization (e.g. elderly, disabled, immigrants, unemployed, etc.) into an

existing social context [29]. The urban gardening initiatives represent platforms for meeting new people, developing social networks, and sharing personal experiences empowering the individualities of each of their participants. Moreover, they are frequently associated with therapeutical qualities and educational possibilities provided through crop cultivation activities [30]. The last one is particularly beneficial for the youth and children as they receive an opportunity to receive first-hand agricultural knowledge on the traditional growing practices from the older generations and get complexly educated on environmental topics applicable in the future [31]. Pieces of evidence fixating the positive impact of UA on the elderly, youth, and children have been underlined in many recent research, demonstrating their improved mental and physical well-being through decreased self-isolation and increased physical activities [32].

Research aim. Although, the stated above theoretical information reveals various aspects of UA initiatives in greater detail, it lacks an actual connection with the practical implementation side of such projects. The absence of real-life explanatory experience of running analogous platforms creates a gap in perception of a common theory and ways of actual project establishment. Therefore, it becomes quite complicated to comprehend the design, operational components, and tools for founding UA activities, only possessing theoretical knowledge.

For this reason, the aim of this paper is to study the emergence conditions of UA initiatives on the real-life operated cases; understand what has influenced their establishment and lead to the formation of such structures; and underpin collected information with the analysis of consequently implemented practices and their constituents. By means of this, the author seeks to uncover the true nature of origin and functioning elements of realised UA platforms to form a better understanding of planning objectives and design recommendations.

Materials and method

The applied methodology of the research was used as a tool for identifying common planning traits of the UA initiatives which would help the future generation of landscape planners with the successful implementation of related projects in the requested settings. For this, the comparative analysis of studied UA practices had been carried out (See Table 1).

In total, 9 international UA projects, predominantly functioning by means of container gardening, were chosen. Such preference was predisposed by the universality of such cultivation method and complete applicability of its objectives regardless of any type of urban environment it can be placed in.

The aspects of project comparison. Based on the most fundamental constituents of a project initiation, the following points of interest have been selected for analysing:

- Location – to form a basic understanding of geographical, demographical, historical, cultural, governmental, and economic aspects of the project.
- Placement – to study the growing and general surrounding environment, its routes of exposure.
- Years of existing – to study year of initiation and project longevity.
- Area – to determine the size of the projected environment and its physical limits for planning.
- Purpose – to identify the goals and aims of the projects and ways of their positive effect on surroundings.
- Target users – to understand who the audience is, what are they looking for in that place, and how it should be planned in accordance with their needs.
- Capacity – to define actual production power of the place based on available area of growing, or a number of growing units.
- Financing – to specify what type of financing is provided to the place, who are figurative bodies in the monetary terms of place functioning.
- Growing medium – to understand what can be used to grow the production and to which extent.
- Grown products – to clarify what greenery can be grown, which cultivation options are the most efficient.
- Additional facilities – to define what type of additional construction units could be implemented at the place.
- Apiculture – to understand to which extent apiculture applied in the relevant practices and considered as an essential supplement to a garden.
- Compost – to determine if composting system is presented in the garden environment, and what supportive role does it serve in the place functioning.

Case studies

Prinzessinnengärten, Berlin.

The Prinzessinnengärten is a mobile community garden located in Moritzplatz in Kreuzberg district, Berlin. It is a former wasteland area previously abandoned and polluted for over half a century that has been converted into a community garden by local residents. The garden has been active since 2009, and throughout this time the area has been rented annually from the city municipality. The Prinzessinnengärten is run by the non-profit organization Nomadisch Grün [33]. The beds for growing are made out of containers taken from the food sector, recycled baker's boxes, tetra packs, and rice sack. The territory also hosts workshop and storage facilities, located in disused and converted shipping containers, playing facilities for children, farmer markets, and since 2011 a seasonal garden cafe [34]. Nobody owns their own beds at the Prinzessinnengarten. The main amount of people is involved voluntarily in garden activities with the aim of sustaining the place. The public grows all kinds of

herbs and vegetables, more commonly turnips, carrots, parsnips, kale, Red Russian kale, radishes, fennel, basil, tarragon, sage, thyme, lovage, salad burnet, sorrel, chard, orache, charlock mustard, and purslane. The aim of this project is to convert open spaces into productive green landscapes where you can learn and try new things together with your community [35].

Gemeinschaftsgarten Tempelhofer Feld, Berlin. The Tempelhofer Field is a park and recreational area located on the site of the former Tempelhofer airport in the Berlin district of Neukölln. It is the largest inner-city open space in the world that hosts altogether 19 activities, like gardening, skating, strolling, and kite-surfing. With its microclimate and placement, Tempelhofer Field is also a refuge for many local species of plants and animals [36]. The history of the Tempelhofer field is complex and eventful. Since the 18th century, the territory was used as arable land by farmers, a military parade ground and training area for the Prussian army, and even as an airport during Second World War times up to 2008 [37]. In 2011, the Berlin-wide network Allmende Kontor came to Tempelhofer Field to construct the first 10 raised beds with around 20 people on an area of 5000 square meters. Since then, the gardener's community has expanded to over 500 people which created more than 250 container beds in a self-organized manner. The community garden has been self-supporting since 2014 by its own association and survives on voluntary donations that help to pay an annual fee of 5000€ to cover purchases of working materials, water supply, and other administrative costs [38].

Tradgard pa Sparet, Stockholm. Tradgard pa Sparet, or Garden on the Track, is one of the biggest non-profit garden associations located in Sweden [39]. The name was received due to the special placement of the garden – an old, abandoned train track area which was turned into a green and vibrant place inside the city. The garden consists of wooden pallets and containers that are used for growing food where some of them have individual sponsors and owners, and some belong to the community as a whole. During the summer weekend, a small café and outdoor scene operate at the place, allowing visitors to have coffee and socialize with others in the process of cultivation [40]. Tradgard pa Sparet has flexible rules for its members what makes urban gardening more accessible and easier for people to get involved in it. The aim of this project is to create, first of all, a social platform for everyone, so participants can learn about growing food and experience the full process of cultivation. As an instance, a special section of it is provided only for children and was made as a collaboration with schools in the local area to teach youngsters about natural processes [41].

Hell's Kitchen Farm Project, Manhattan, New York. Hell's Kitchen Farm Project (HKFP) is an urban rooftop farm located on the fifth floor of Metro Baptist

Church. It took a challenge of addressing an issue of nutritional security, especially the scarcity of affordable fresh produce local residents faced in recent years. The garden was created 10 years ago by merging of four neighbourhood organizations, – a housing development company, a metro ministry, and church communities that decided to band together against the common problem. The farm operates on 370 square meters with the 100 sq m gained from the raised beds. As a growing medium, organizers choose kiddie pools with drilled drainage holes due to the weight factor that the old structure of the church roof can hold. The most popularly grown crops presented at the farm are basil, beans, blueberries, cabbage, collard greens, chives, cucumbers, eggplants, garlic, kale, lettuce, oregano, peas, peppers, potatoes, radishes, rosemary, scallions, and tomatoes. All produce from the farm goes directly to the local food pantries and charity organizations where the food got distributed between the community and people in need. However, the mission of the farm also states for youth education, so together with local school programs, HKFP offers internship places and yearlong studying programs for youngsters that focus on studying growing systems, the complexity of UA, and healthy life-style cultivation [42].

Food From The Sky, London. Food from the Sky was the first rooftop food growth and educational project located in North London from 2010 till 2014 [43]. The aim of this project was to create a permacultural community garden that would sell grown food in the supermarket below while providing learning space for the community upstairs. In this way, the farm could correspond both to commercial and educational-social criteria. The grocery store began its collaboration with the project leader Azul-Valerie Thome with only 10 tons of compost and 300 recycling growing boxes but with the time and help of volunteers, the garden was able to supply freshly harvested food to the supermarket on the regular basis [44]. Among the crops that had been grown were vegetables, fruits, mushrooms, and herbs, all cultivated following organic standards with the local community. Any fruits or vegetables that weren't sold, became a part of the compost programme for sharing and enhancing the soil for the next season of produce. Besides the main activity of the project, throughout the four years of its functioning, it ran a training programme and foundation course on food growing, biodiversity, and living a sustainable life which was called Seed2seed [45].

The Jonathan Club, Farmscape, Down-town LA. The Jonathan Club is a commercial UA project located in Downtown LA, established for the on-site restaurant by Farmscape company. Farmscape is one of the largest UA firms in the US that design, install, and maintain hundreds of farms across the state. Its aim is to create gardens that will connect people to a fresh, local source of food right in their neighbourhoods with

a focus on low-water management and sustainable landscaping [46]. Farmscape has collaborated with the Jonathan Club rooftop farm for nearly a decade. The farm occupies around 300 square meters of the roof space and consists of 56 stock tank planters, nearly 300 citrus trees, passionfruit vines, and blueberries, and a greenhouse that supplies the restaurant with the food cultivated in the shadiest corners of the space. Additionally, to the direct benefits that the garden provides to owners, it also adds monetary value for the area attracting and bringing in new developers, building professionals, and government agencies [47].

Cadillac Urban Gardens on Merritt, Southwest Detroit. Cadillac Urban Gardens (CUGM) is a community garden project initiated by General Motors company that provided 250 shipping crates to the citizens of the district to turn them into the raised beds at the place of the former parking lot. The project is sponsored and supported through the collaboration of GM Supplier of the Year Ideal Group, and composting company Detroit Dirt [48]. The garden serves as a place for residents to meet, get access to fresh fruits and vegetables, share their knowledge, and exchange experience in growing. CUGM allows residence without private lands to do gardening, come and cultivate some produce which in turn leads to changes in their eating habits and builds a food security system for locals. On top of that, the garden community follows a zero waste philosophy. The majority of materials presented in the garden are reused, recycled, or upcycled. In this way, the garden's mission covers not only growing but rather cultivating community engagement, its health, and security, together with practicing environmentally sustainable management of the area [49].

Lewes Community Accessible Allotment, Brighton, UK. Lewes Community Accessible Allotment (LCAA) is a specially designed project for people with disabilities and younger members of relevant educational facilities. The design idea implied the creation of a growing space that could allow easy access for cultivation for individuals with different disabilities; promote growing opportunities starting from sowing a seed till harvesting ready produce for all; and provide a safe space/shelter with access to water and other utilities, potting area [50]. Landscape company Alitura, responsible for the design part, planned the garden with plenty of free space in order to provide easy access for people on wheelchairs and with mobility vehicles. Apart from this, to maximise the efficiency and functionality of the garden, Alitura placed plants with diverse forms and varieties. In this way, people with a greater diversity of disabilities could interact with greenery, e.g. on the vertical space of growing instead of horizontal. For a safer and more comfortable use of a wheelchair, designers brought wheel-friendly landscaping material made of Nidagravel units that cover all surfaces at the allotment.

[51]. LCAA is supported by many funders that deliver outdoor sessions and horticultural therapies. The whole plot is cultivated by its members, and grown produce is equally shared between all participants [50].

Sedona Winds Community Garden, Arizona, US. Sedona Winds Assisted Living (SWCA) is an accessible community garden designed for the elderly and disabled people. It was launched by local residents and volunteers headed by Ed Naylor, a former Lutheran pastor, just in four months period. All the construction and development works were accomplished in more than 500 hours with the help of participants, raised donations of over 15,000 dollars, and the charity support of local businesses [52]. The organization that stands behind the construction of the project, is called Gardens for Humanity. The garden project planned by them fully corresponds to all accessibility criteria and includes a main square for gardening, sheltered outdoor space with benches for the visitors, and wide walkways made out of pavers. As for the garden plaza, it was specially designed by means of raised containers with available space in the lower part for the people on wheelchairs, walkers, and scooters [52].

Conclusion and Recommendations

Following completion of the data table, the comparative analysis of studied urban agricultural practices had been carried out, and furthermore developed into the open concluding guidelines for the establishment of subsequent initiatives.

Location. Based on the conducted case study analysis, the general location of the projected UA initiative plays a crucial role in its further development. The experience of the implemented objects demonstrates a correlation between the scale of the city and the suitability of certain projects within them. Suchwise, a landscape architect should always keep in mind the relativity of causes and issues that are planned to be covered with agricultural platforms to the economical, ecological, cultural, and political state of things within the chosen city. Hence, the success and longevity of the project's existence will strongly depend on the total response received from the city residents and municipality. If the urban agricultural platform is intended to be realised as a private object, its positioning won't be necessary tied to certain locality parameters. As on the whole, this type of initiative is more secured due to the stable financial and administrative support from sponsoring structures (e.g. Lewes Community Accessible Allotment, Brighton, UK; Sedona Winds Community Garden, Arizona, US). Meanwhile, socially based public projects should be considered to be placed in a responsive and encouraging environment which could be open to acceptance of alternative green urban spaces. In a manner, to date, it is more reliable and effective to establish UA initiatives in the bigger cities with the wider range of issues to be covered (lack of open green

public spaces, immense presence of abandoned urban areas, nutrition deficiency of urban residents, etc.), and higher social/political/economical endorsement (availability of diverse urban planning/food policies within big cities municipalities, international grants, greater community feedback).

Placement. Once the location of a project had been chosen, its placement is set to be determined. In terms of it, as it was demonstrated by the case study, there are plenty of opportunities for the garden initiation, including open-soil direct cultivation and raised bed growing. The initiative can be placed in any available spot (e.g. rooftops, parking lots, former industrial facilities territories, etc.), thus the range of options is wide and flexible, allowing planners to adapt all kinds of urban areas for the gardening and needs of targeting audience. If a chosen territory doesn't have a history of pollution and presents opportunities for direct cultivation with open soil, then it could be instantly turned into the gardening green complex. Whether it has some level of soil contamination or features hard surface covering, the garden can be run by means of various upraised planting mediums. However, there are still some general rules to be followed while choosing a plot, such as: 1. Avoid settlement of gardens closer than 20 m from roads with heavy traffic due to the possibility of migrating heavy metal contamination; 2. Check spot for presence of invasive plant or animal species which could be a threat to the place; 3. Think about the minimal accessibility of water and light sources. 4. If the garden is placed on the rooftop, calculate maximum pressure the construction can hold. 5. Constantly cross-reference the purpose of the place and its targeting users with physical conditions the spot provides to make the greater choice.

Years of existing. As the data table indicates, the only place that got closed within the studied cases is Food from the Sky, London, UK. Nevertheless, the overall statistic of timewise functioning of UA initiatives is not so optimistic. This leads to another essential point – project lifetime. While cases discussed in the article present rather pioneering and unique events in UA history, most of the less well-known and smaller practices have been cancelled over time. The reasons for this outcome might vary but the most common is a matter of constant alteration of policies in terms of land leasing from the municipality (in case of public gardens), cancelling or premature ending of temporary social garden projects, and economical changes within countries of location [53; 54]. Therefore, the time factor should be reviewed on an equal basis with placement as it might influence the physical appearance of the gardens, their objectives, and ways of cultivation.

Area. While setting and determining parameters for the desired gardening territory, it is necessary to think about the area constituent and its sizing. Depending on the aims and targets of the projected initiative, one should understand which amount of land would be

sufficient to use. The held case study reveals that small-scale projects associated mostly with recreational, therapeutic, or private commercial activities, can successfully and efficiently operate on 300-400 sq.m. Meanwhile, the ones oriented on larger-scale social involvement or production power, can reach up to 6000 sq.m. Whatever the case is, the primary establishment of such projects should always start from the smaller scales to ensure the full understanding of the gardens' capacity, cultivation ability, and functionality as a whole [55].

Purpose. As it was mentioned in previous conclusion blocks, the selected purpose of the place is closely linked to the following preferences picking for physical characteristics of the UA initiative. The objectives endowed to the place should strongly correspond to the general environment of placement and external request from society, municipality, or existing operational conditions of an area, to ensure the success and longevity of an initiative. Since the UA concept already includes social factors by its very nature, it is crucial to ascertain that a planned project can cover more than one bias and create a multi-functional environment for its users.

Target users. The factor of users is a key setting that planners should define before the start of a garden. When the purpose, placement, and area are set, it is essential to understand: who the audience is, what would they need at that place, and what functional distribution of areas would work for them in the best way possible. For that, if an area is public and open, and not limited by one specific category, it is useful to do a brief demographical analysis and overview of the existing educational, cultural, commercial, and residential places that could influence visitors, and following this, develop respective planning and relevant supporting facilities.

Capacity. According to the conducted case study table, it can be seen that garden capacity varies a lot depending on the area size, its usage, and functionality. There is no particular correlation between the amount of growing units/area and the total square of a garden what can be explained by varied prioritization of land usage.

Financing. The considered case study analysis indicates that each of the reviewed initiatives has varying financial sources of income, where approx. half of them fully depend on external support (donations from users, municipality, hosting organizations), and the other half runs inner commercial activities in order to sustain themselves. The interrelationship between ownership positions (private/public) hasn't been noticed. Although the projects existing under the protection of the public authorities which tend to be developed in a top-down approach, are inclined to have established financial backing from their sponsors. Meanwhile, bottom-up initiatives are confronted frequently by lack of funds what leads them to develop

TABLE 1

The comparative analysis of selected studied UA practices [created by authors]

Name	Prinzessinnen gärten	Gemeinschaftsgärten	Tragård pa Sparet	HKFP	Food from the Sky	The Jonathan Club	CUGM	LCAA	SWCA
Location	Berlin, Germany	Berlin, Germany	Stockholm, Sweden	New York, US	London, UK	Los Angeles, US	Detroit, US	Brighton, UK	Arizona, US
Placement	Former wasteland	Former airport	Former railway tracks	Church rooftop	Supermarket rooftop	Restaurant rooftop	Former parking lot	Allotment gardens	Courtyard
Years	2009 - till now	2011 - till now	2012 - till now	2010 - till now	2010 - 2014	2013 - till now	2012 - till now	2015 - till now	2013 - till now
Area	6000 m ²	5000 m ²	n/a*	370 m ²	n/a	300 m ²	n/a	345 m ²	n/a
Purpose	Social, environmental, educational	Social, environmental	Social, educational	Food security, social	Commercial, social, educational	Commercial	Social, environmental	Social, therapeutic	Social, therapeutic
Target Users	Middle-aged people	Middle-aged people, young families	Middle-aged people, children	n/a	n/a	n/a	Adults, families, children	People with disabilities	Elderly, people with disabilities
Capacity	>500 growing units	>250 growing units	>50 growing units	52 growing units	>300 growing units	>50 growing units	>250 growing units	n/a	n/a
Financing	Inner commercial activities	Voluntary donations	External financial support	External financial support	Inner commercial activities	Inner commercial activities	External financial support	External financial support	External financial support
Growing Medium	Recycled food containers	Raised wooden beds	Wooden pallets and containers	Kiddie pools	Raised wooden beds	Stock tank planters	Shipping crates	Raised wooden beds for people with disabilities	Raised wooden beds for people with disabilities
Grown Products	Root veg., salads, herbs, ind. crops	Root veg., salads, herbs, ind. crops	Root veg., salads, herbs, ind. crops	Berries, herbs, cabbages, root veg., salads, beans, etc.	Vegetables, fruits, mushrooms, herbs	Vegetables, salads, herbs, citrus, vine plants	Root veg., salads, herbs, ind. crops	Root veg., salads, herbs, ind. crops	Root veg., salads, herbs, ind. crops
Additional Facilities	Garden kitchen, tool storages	Tool storages	Garden cafe, greenhouse tunnel	Food pantry	Greenhouses	Greenhouse, restaurant	Greenhouse tunnels	None	Sheltered outdoor space
Apiculture	Yes	No	No	Yes	Yes	No	Yes	No	No
Compost	No	Yes	No	No	Yes	No	No	No	No

n/a* - not applicable

independent inner sources of funding (establishment of food markets and cafés, hosting of cultural activities, gardening workshops, etc.).

Growing medium. In regard to plant cultivation by means of modular raised beds or appropriate objects, the choice of mediums is greatly broad and unlimited. As demonstrated by studied practices, virtually any tank or container could be turned into the planting environment. If the budget of a garden is low or its objectives involve ecological education, upcycled food containers or shipping crates will do great, as far as they suit the physical characteristics of cultivating crops. This option also serves as a perfect opportunity for gardens to be mobile and flexible in terms of their structure and placement. Nonetheless, it is important to remember about accumulating contamination factor frequently occurring in the closed medium space and resulting in a high level of soil pollution over time.

Grown products. Referring to the cultivating crops selection, most of the studied cases have a similar growing assortment. As indicated in the summarizing table and confirmed by the experience of implemented UA projects, the most common and efficient cultivars for urban environment are: root vegetables (turnips, carrots, beets, etc.), salads (lettuce varieties: leaf lettuce, romaine, iceberg; spinach, chicory), herbs (basil, thyme, parsley, dill, etc.), and cabbages (bok choy, savoy, kale, cauliflower, etc.). There were partial cases of beans and mushroom farming, but they haven't been much popularized due to the more complicated nature of growing and required advanced cultivation settings. Comparing, turnip plant can mature in a month from the moment of direct seeding, carrots – 2 months, and lettuce – 1.5 months, what provides them with a great advantage in terms of crop rotation rate and simplicity of maintenance.

Additional facilities. The case study has demonstrated that the choice of additional garden facilities is rather an optional prospect strongly associated with the primary function of a farming platform and alleged time spent there. In this manner, there could be distinguished recommended primary constructions, such as tool sheds, sanitary cabins, sheltered outdoor spaces for meeting, and food pantries; and supplementary arising from the objective function, like greenhouse tunnels (with a need of cultivation extension), or garden kitchen/cafe/restaurants (for running commercial and cultural activities).

Apiculture. As it was stated in the analysis, apiculture as a separate activity has been observed only

in half of the cases, which, remarkably, position themselves as ideologically organic or permacultural practices. However, this relationship might be additionally justified by the placement specifics of the mentioned projects and the difficulty of natural bee access to these areas. While some projects are located in places of relevant proximity to urban green zones or natural green areas, giving them the advantage of established availability of pollinators at the nearby territory, others can face a deficiency of bees and necessity of artificial involvement due to the harsh urban surroundings. Hence, in this case, beekeeping would be rather essential than just supplementary action, and should be followed for ensuring pollinating process within the garden and strengthening conserving environments for pollinators.

Compost. Same as apiculture, usage and presence of compost system were noted only in a minority of cases. The accurate correlation and link between composting system availability and an initiative is hard to determine but the appliance of compost itself was described in all practices. Meanwhile, the installation of the system can be unfeasible due to the area limitations or lack of administrative rights, the benefits of compost usage in gardens are undoubtful. Therefore, some urban farmers have established relationships with local composting factories for the supply and donation of organic matter. In this way, it is hard to conclude the actual necessity of composting system construction in each of the urban gardens with the present partnership options as stated above. However, if a planner has the possibility to include such a supporting structure within its project, it could assist a place significantly in terms of consequent advantages with organic waste recycling, soil enriching and rebuilding, and reducing a need for chemical fertilizers appliance.

Summary. The conducted case study could be used as a referring recommendation paper during the primary stages of UA initiative establishment. Together with a brief theoretical part, it might be served as a reasoned core for analysis and argumentation of newly designed environments by landscape architects and city planners. The overall characteristics and received examined results shall be projected on further settings carefully and in accordance with relevant socio-economic, environmental, and political backgrounds.

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Kopsavilkums. Pasaules straujā izaugsme un attīstība ir novedusi pie būtiskām izmaiņām pilsētu izplešanās procesos, zemes sadalījumā un mūsdienu pilsētu vispārējā funkcionēšanas modelī. Problēmas, kas saistītas ar ekoloģiju, ekonomiku, cilvēku fizisko un garīgo labklājību, ar katru dienu kļūst arvien aktuālākas, jo rodas atvērtu zaļo zonu trūkums, uztura drošība un ilgtspējīgi finanšu modeļi mazajiem uzņēmumiem pilsētās; un ietekmē ne tikai parastos iedzīvotājus, bet arī vispārējās pilsētu un ainavu plānošanas tendences, kurām vajadzētu risināt konkrētos jautājumus. Viens no instrumentiem cīņai pret tiem pēdējās desmitgadēs ir kļuvis arvien populārāks pilsētu lauksaimniecība, kas īpaši izvēlēta kā šīs publikācijas interesējošais objekts. Raksts atspoguļo kompleksus pētījumus, kas veikti integrētā veidā, pārskatot pilsētu lauksaimniecības vispārējo parādību un tās novatorisko praksi; nosakot to veiksmīgas darbības galvenos komponentus un pozitīvus veidus, kā ietekmēt apkārtni; un līdz ar to veidojot noslēguma ieteikumu sarakstu šādu struktūru plānošanai un pārvaldībai. Kā galvenās izpētes metodes autore izmantoja selektīvo gadījumu izpēti, kurā aprakstītas galvenās iezīmes, literatūras analīze pamatinformācijas apkopošanai. Pētījuma rezultāti tika apkopoti kopsavilkuma tabulā, kurā uzsvērti pamatdati un atbalstīts izstrādātais secinājums, kas balstīts uz pārbaudi un ieteikuma izstrādi ieinteresētajām personām.

The influence of traditional Chinese landscape architecture on the image of small architectural forms in Europe

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Abstract. The article analyzes the influence of traditional Chinese landscape architecture on the shaping of European small architectural forms and the influence of European architecture on contemporary Chinese architectural practice. The purpose of the article is to identify the features of the architectural mutual influences of Chinese and European cultures. The method of historical analysis, the method of comparative analysis and the graphoanalytical method are used. The lack of identity between the Chinese and European gardens and the park with the pavilions is proved at the different hierarchical levels. Two groups of European Chinoiserie style pavilions have been identified: which give a false idea of Chinese architectural traditions and which represent a simplified version of those traditions. There is noticed the influence of the traditional Chinese approach to the architectural objects placement in the natural environment on the development of the contextualism concept in Western architecture (since the 1960s) which proclaims its purpose to preserve the natural beauty of the site through careful design that relates to its surroundings. The concept of contextualism is now widely used in the design of small architectural forms in the urban environment and in the design of the architectural environment in general, both in Europe and in China. This is a clear example of mutual enrichment with the ideas of two civilizations, each of which preserves its own culture.

Keywords: Chinoiserie style, European regular park, Chinese garden, basic canons, small architectural forms

Introduction

The authenticity of the "Chinese theme" embodiment in the European Chinoiserie style still remains the subject of scientific debate. Unlike traditional Chinese gardens, where small architectural forms – pavilions – merged with the natural environment and were defined by it, in the structure of traditional European regular parks Chinoiserie style pavilions – gazebos, tea houses – were used as a kind of theatrical decoration. That is why the question of some of these objects' stylistic value is debatable.

In our opinion, it is undeniable that the basic principles of traditional landscape design have not been borrowed in the Chinoiserie style, but the value of individual objects, which in general resemble Chinese pavilions, is that they represent a certain era, ie. their value (except for individual objects) is primarily historical.

Materials and Methods

In studying scientific publications to prepare the study, the authors proceeded from the fact that to conduct a comparative analysis between the objects of traditional Chinese architecture and examples of European Orientalism must first characterize the defining features of Chinese architecture, design and art, determine the causes of Orientalism in Europe and its manifestations in different countries and in buildings of different functional purpose. From this point of view, the publications of Ukrainian researchers M. Dyomin, A. Dmytrenko, Yu. Ivashko, M. Orlenko, T. Kuzmenko, D. Chernyshev and the Polish researcher D. Kushnezh-Krupa were studied [6; 7; 8; 16]. Topics related to Chinese landscape design, architecture of small

pavilions, traditional Chinese architecture were studied by Li Chunqing [12], Wang Yi [22], Pan Jiaping [17], Tong Yu Zhe [20], Zhu Guang Yu [29], Jiang Zhenpeng [10], Xing Yue [24, 25], Fang Liqiang [1], Huang Wei [5], Pei Yuansheng [18], Wang Guanglong, Zhang Hangling [21], Gong Lingjuan [4], Zhou Weiquan [28], Liu Dunzhen [13], Zhao Guanghua, Qiu Mao [26], Zhu Junzhen [30], Lou Qingxi [15], Fang Zhirong [2].

The article also uses materials of field research conducted by Yu. Ivashko and O. Ivashko during 2007 in the Ukrainian aristocratic landscape parks "Oleksandriia" in Bila Tserkva and "Sofiivka" in Uman to analyze the Chinese gazebos location in the regular park structure.

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

Basic principles of planning a traditional Chinese garden and varieties and main factors of shaping small architectural forms (pavilions)

The evolutionary development of traditional Chinese gardens has led to their division into numerous varieties according to social hierarchy and functional purpose: imperial gardens, private gardens of famous people, gardens at temples and monasteries, public gardens and more. The leading idea of Chinese landscape architecture was the idealization of the natural landscape, and architectural objects played a secondary role.

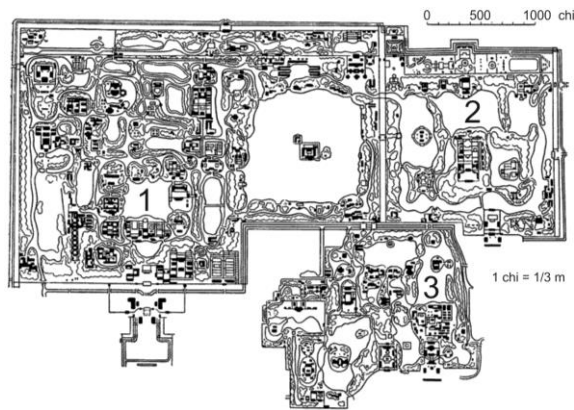


Fig. 1. Planning of the Imperial "Garden of All Gardens" Yuanming Yuan: 1 – Garden of Perfect Brightness; 2 – Garden of Eternal Spring; 3 – Elegant Spring Garden.
[drawings from the private archive of P. Chang]



Fig. 2. Master of the Nets Garden, Suzhou. View on the Moon Comes with the Breeze Pavilion [photo by M. Zychowska]

Tomasz Kozłowski expresses a fair idea about the non-identity of the concepts of "beauty" and "art" in the modern world [11]. At the same time, the peculiarity of the Chinese garden is precisely the identity of these two concepts.

From the modern point of view, the garden of ancient China seems as the embodiment of the Confucianism and Taoism basic principle: "Everything flows, everything changes." The same principle is the basis of the Chinese Book of Changes "I-Jing". Walking through the garden, a person observes how one space flows smoothly or abruptly into another, and each step changes the "landscape scenes", which are harmoniously combined into a single system.

The embodiment of the principle of "flowing spaces", the species landscapes of which change with each step, is clearly seen in the layout of the imperial "garden of all gardens" Yuanming Yuan (Fig. 1), where we can trace the emphasized hierarchy of these "flowing spaces". This is the main philosophical concept of the garden of ancient China: the harmonious unity and hierarchical subordination of the three main ontological components of the world: Heaven, Earth and Human. Unfortunately, European "Chinese-style" landscaping often ignores this concept, instead recklessly

accumulating a bunch of small "Chinese-style" architectural forms, leading to a disharmony of the unfolding, perception, and "misunderstanding" of the ancient Chinese gardens basic philosophical doctrine.

An important aspect is also the psychological perception of the traditional Chinese garden, as European parks with pavilions of the Chinoiserie style have not inherited this atmosphere.

For example, the Master of the Nets Garden (Wǎngshī yuán) is one of the wonderful classic gardens in Suzhou (Fig. 2). Perfectly preserved and surrounded by extraordinary care, inscribed on the UNESCO World Heritage List, it is a charming enclave of peace and quiet, although it is surrounded by a city of millions. It seems that time has stopped here. This unique place is a synthesis of traditional garden art and rich in architecture details. The whole complex consists of several separate spaces, such as private garden spaces and miniature alleys, in which there is an unbroken harmony between the nurtured greenery and the stone walls. Old, large trees and unusual dwarf bonsais stand against the backdrop of pavilions covered with curved, ornate roofs, with corners decorated with sculptures of formidable dragons. Intricate patterns with animal and plant motifs fill the blinds on the windows. Sometimes there are small springs or larger ponds that, like mirrors, reflect the surroundings. Its peace is disturbed by floating large red carps. All buildings and pavilions together with greenery create a homogeneous space in which the atmosphere is filled with the spirit of centuries-old history of Chinese culture and art.

Since the theme of European stylizations "in the Chinese style", in particular, the specific features of the Chinoiserie style in the structure of a regular European park, is directly related to the small historical architectural forms of China in the natural environment. First of all, it is necessary to determine the factors influencing the emergence, formation and development of Chinese garden and landscape pavilions and analyze what determined their original silhouette due to curved roofs, specific design schemes, decor and polychrome.

It is noteworthy that all the small architectural forms of China in the Chinese scientific literature are often characterized by the term "pavilion", although in fact there are closed and partially closed pavilions with walls, and open gazebos on pillars.

The type of small Chinese pavilion (a model for a European gazebo), has gradually evolved, its functions and forms have varied over the course of evolution, but it has remained a link between human and the natural environment for thousands of years. The traditional Chinese pavilion played the role of a place of sacred inner communication of man with his inner world of feelings and the Universe, through the pavilion nature enters the human soul. The pavilion, which originally arose from functional needs, later diversified its functions, but remained the basic principle of the secondary nature of the pavilion to its surrounding nature.

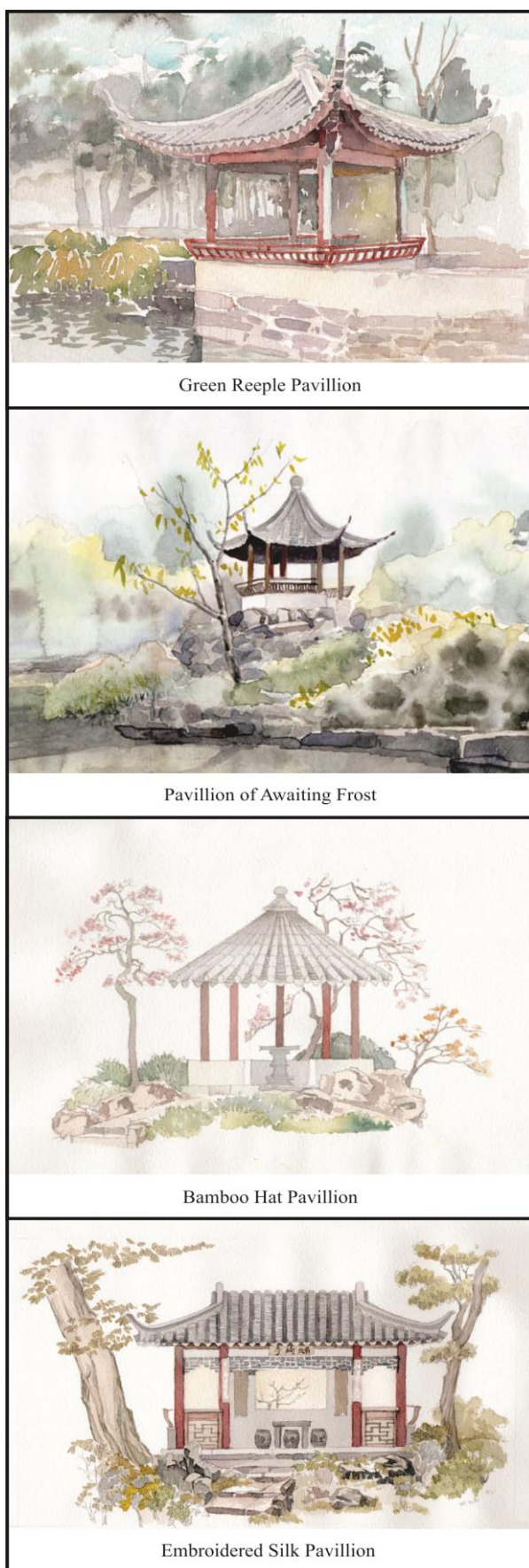


Fig. 3. The pavilions of Zhouzheng Yuan Garden in Suzhou as a canon of Chinese landscape small architectural forms design [Watercolors by P. Chang, 2020]

The newest, strange as it may seem, is the type of garden pavilion for aesthetic pleasure and solitude in nature (Fig. 3), although this type of pavilion often embodies traditional Chinese architecture outside the country. In the Ming and Qing eras, a specific type of garden pavilion called "floating cups" emerged [19, p. 26]. Ji Cheng used the term "landscape art" (yuan ye), and in his understanding it meant that pavilions, both among flowers and on the water, serve one purpose – to emphasize the beauty of nature with architecture [19, p. 38]. This led to the richness and diversity of the architectural image of the pavilions, because despite the fact that it was a pavilion – water, roadside or temple – its spatial-and-planning solution has always been adapted to the environment and formed according to it. From this point of view, a typical example was the spread of pavilions in the mountains for a panoramic view of the landscape, when the pavilion stood on top and the landscape was not covered by trees. Such a pavilion was the most impressive and seemed like a mirage that merged with the sky, reflecting the sun's rays with a tile. It was considered to be the best type of pavilion for visual impression. For example, such was the Pavilion of Holding the Sun in Mount Jiu hua, which overlooked the sunrise and the sea of clouds in the endless sky. This pavilion belongs to the common type of pavilion for watching the sunrise (tian tai xiao ri). Examples of mountain pavilions are The Second Spring under Heaven Pavilion at Mount Huishan, the Thatched Pavilion at Mount Qingcheng, and the Pavilion Heart-cleaning Pavilion at Mount Emei).

Another group consisted of pavilions that made the most of the aesthetics of water – water pavilions were built on the water, on the coast, above the springs, the water surface and the sound of the waves merged into one common concept with an artificial building. Here you could drink tea, admire the game of fish, the glow of the sun on the water.

Examples include the Mid-Lake Pavilion of West Garden in Suzhou, the Five-Dragon Pavilion at the North Shore of Taiye Lake, in Beihai Park, Beijing, World View Pavilion at West Lake, Hangzhou, Music Terrace (Chuitai) in Yangzhou, Pavilion of Spring Notes – Zhichun Pavilion of Summer Palace, Vid-lake pavilion at Xiyuan, Lotus-surrounding Pavilion – Su Feng Si Mian Pavilion in Suzhou, Kaiwang Pavilion at the West Lake of Hangzhou, Sizhao Pavilion of Shihu Garden in Weifang and others. A special group consists of garden pavilions among flowers or dense trees, as well as pavilions-labels of springs, the so-called spring pavilions, which performed a dual function – the allocation of space and at the same time decorating the landscape [19, p. 46, 50].

The main difference between the European park for mass visits from the Chinese garden is their different purpose, because the garden, often surrounded by walls, was mainly intended for indoor use of families with guests (whether imperial or just wealthy), and temples

and monasteries gardens also were not designed for visitors.

It was important for a European to show architecture in nature, which became a picturesque background for architecture, for a Chinese – to make architecture as complementary as possible to nature, architecture became a background for the natural environment. This explains the choice of stylistics of the pavilions, when the landscape determined their location, size, silhouette, height and color. That is why even the imperial pavilions looked quite modest – if required by the natural environment. This emphasizes the traditional Chinese saying "the pavilion becomes famous through the natural landscape, and the landscape is decorated with a pavilion" [19, p.48]. Cheng Yuwen in the Ming era declared the idea of simplicity of the pavilion and its maximum naturalness in form and design.

However, along with simple pavilions (Thatched Pavilion in Mount Qingcheng, Sichuan Province) there were also luxuriously ornamented pavilions. This led to the gradual division of the pavilions into two groups – simple and luxuriously decorated (Sunset Glow Pavilion in Lintong, Shaanxi Province, Biluo Pavilion in Qianlong Garden of Forbidden City in Beijing). However, simple reed pavilions, which embodied the idea of expressing naturalness in the use of undecorated materials – reeds and bamboo – found a place not only among the mountains and forests, in remote corners, but also in the imperial gardens [2, p.62].

Location of Chinese-style pavilions in the structure of European parks and non-identity of European park and Chinese garden

The fundamental difference between Eastern influences on European architecture at different stages of historical development was that at the stage from Baroque to Historicism architects tried to recreate authentic Chinese forms in a fundamentally different environment, without the necessary basic knowledge of stylistic features, and at the stage from Historicism to modern architects they no longer sought to literally recreate a Chinese or Japanese building, but instead creatively interpreted the principles of formation and planning, based not on a philosophical-religious but on a rationalist Western basis.

For thousands of years, the philosophy of China's private garden was formed, which was to create the impression of a space for solitude in nature and tranquility, as the Chinese garden was originally conceived as the embodiment of harmony and ideal peace, while the Chinese theme in European palaces and mansions became another exotic element of entertainment.

As Tomasz Kozłowski noted in his monograph, "this is a feature of art that is to meet the need for entertainment, which is the main feature of mass culture. The category of a fairy tale and its consumer Homo ludens, i.e. "a playing human", appear" [11, p. 201]. This fully characterizes the Chinoiserie

style in relation to Chinese architecture and landscape design.

E. Golosova emphasizes the Chinese origins in the formation of the so-called English natural landscape park, even uses the phrase "English-Chinese park", but at the same time, characterizing the Chinoiserie style in relation to its models in China, she emphasizes that Chinoiserie style was a European design, the theme of China and a generalized image of a rich, exotic and mysterious country through the eyes of people who have never been there [3]. Since she is a botanist, she was primarily interested in whether the basic techniques of the Chinese garden were embodied in the European landscape design of the Chinoiserie style, and her answer was as follows: "The images of landscapes in the Chinoiserie style have remained only images and almost never turned into real landscape art. Bizarre mountain landscapes with a web of bridges, light and graceful bamboo pavilions, waterfalls, boats with dragons and phoenixes, decorated with flowers, remained mostly only on canvas, wallpaper, porcelain and silk.

Nevertheless, some Chinese elements can still be found in gardens, but they, like all other manifestations of the Chinoiserie style, have practically nothing to do with Chinese culture, except for a hint of origin.

Such Chinese elements in the garden landscape of the Chinoiserie style are pagodas, pavilions, bridges, i.e. exceptionally small architectural forms" [3, p. 240]. Emphasizing the basic difference between a traditional Chinese garden and a park in the Chinoiserie style, E. Golosova, in particular, notes: "European landscape architects have always attached great importance to garden structures, especially in order to place emphasis on the landscape and achieve its completion. After all, according to both architects and scientists of the time, the landscape park should only resemble a natural landscape, emphasizing its craftsmanship. "Chinese houses" – architectural curiosities, cheerful and strange – began to appear on the territories of large estates, as vignettes of the Chinoiserie style in a clearly non-Chinese environment" [3, p. 240].

We have deliberately quoted in detail from a scientific article, because we are interested in the opinion of a botanist, not a landscape architect, who on the other hand confirmed the conclusions about the theatricality of landscape design in the Chinoiserie style and its detachment from what the traditional Chinese garden was based on.

E. Golosova as a botanist concentratedly expressed the quintessence of the Chinese and the Chinoiserie style gardens: in the first case – the dominance of nature and reducing the role of man-made elements, the use of a list of techniques based on the maximum use of natural forms as means of expression, in the second – emphasizing human role in transformation space, therefore, the possibility of the natural environment isolation from architecture and the use of architectural objects as the main dominant focuses of the park.

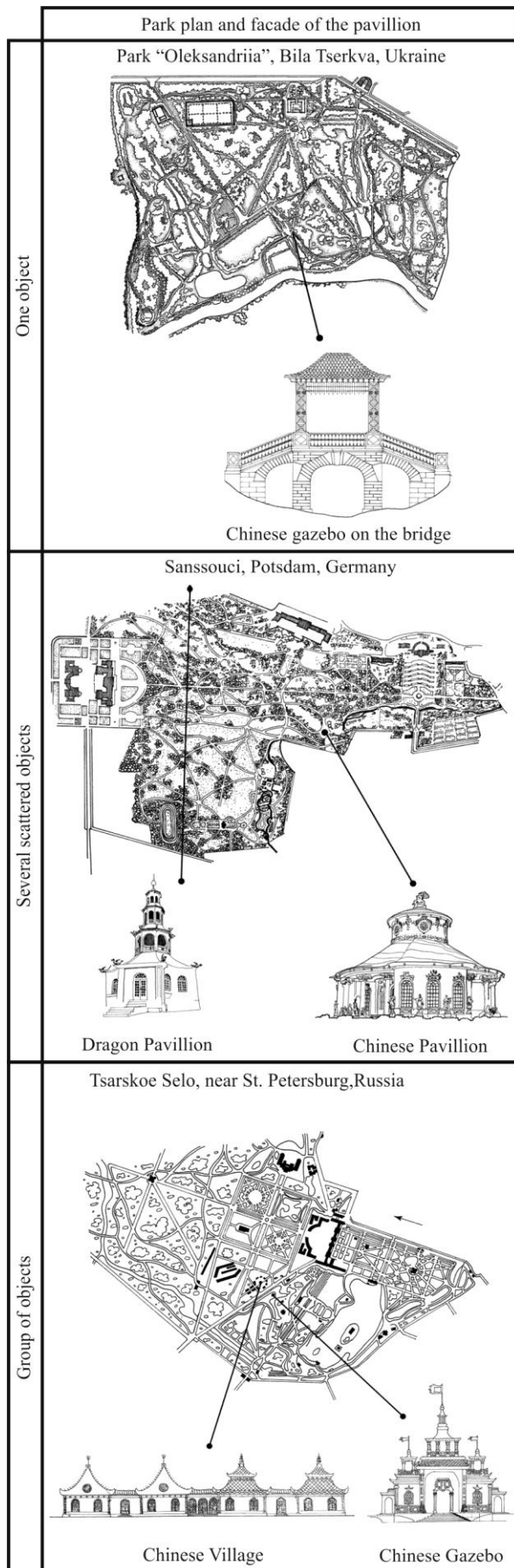


Fig. 4. The Chinoiserie style pavilions in the structure of regular European parks [idea of Yu. Ivashko, drawings by P. Chang]

The main types of accent architectural forms in Chinoiserie style parks are pagodas and pavilions, without understanding their location in the traditional Chinese landscape environment with a certain symbolic meaning: examples are Buddhist pagodas and towers in gardens, and often – drawings on porcelain vases.

In fact, a Chinoiserie style garden was a covert attempt to escape from the everyday world to the dream world, as evidenced by a critical quote by E. Golosova about the Chinoiserie style garden by Richard Payne Knight, English philosopher, art theorist and poet, who advocated the purity of styles: "easy and fabulous and inanimate, a child of fruitless imagination, whim and fancy" [3, p. 241].

The important difference between European parks and Chinese gardens is the number of Chinese (Chinese-styled) pavilions: in most European parks it is a single pavilion (at most – a compact group of pavilions forming the so-called "Chinese village"), which does not affect the perception of the overall composition of the park (Fig. 4), as Chinese sources mention a significant number of pavilions that emphasized the landscape beauty of the outstanding landscape.

For example, there were about a hundred pavilions around West Lake in Hangzhou, about seventy in the largest imperial garden in Chenzhe, and about fifty pavilions in the Emperor's Summer Residence (most of which are concentrated on the terrain, near the lake or in the Garden of Pleasant Harmony, i.e. in the most expressive picturesque landscapes).

The causes and specifics of the Chinoiserie style manifestations in Europe

Analysis of the phenomenon of national Chinese cultural and artistic traditions transformation in European architecture of the period 18th – early 20th centuries proves the literal non-identity of European oriental buildings and traditional ancient Chinese architecture.

Like artists and writers, following Chinese traditions "by their own understanding", European and Russian architects were guided by European principles of aesthetics and beauty, without thinking about the philosophical and esoteric content of each form, element, or quantity.

However, the number of elements and groupings of buildings in China had a clear meaning: the basis was the trigrams Qián (symbol of Heaven) and Kūn (symbol of Earth). According to Liji treatise, temples dedicated to the emperor's ancestors were to be placed in front of the palaces, and the living quarters were to be located behind the palace. According to the Feng Shui canons, the building should be oriented along the north-south axis, with the orientation of the main facades to the south. If we analyze what types of Chinese buildings by function have become the main role models in Western Europe and the Russian Empire, it is primarily garden pavilions and gazebos, on the model of which began to build "oriental" gazebos and so-called "tea houses" (Fig. 5).













Chinese pavillions in Suzhou gardens	European Chinoiserie style pavillions
 <p>Lotus Breeze Pavillion in Zhuozheng Yuan Garden</p>	 <p>The Voliere of the Chinese palace in Drottningholm, Sweden</p>
 <p>Fan Pavillion in Shi Zi Lin Yuan Garden</p>	 <p>Chinese Pavillion in Sanssouci Park in Potsdam, Germany</p>
 <p>Cloud Capped Pavillion in Liu Yuan Garden</p>	 <p>Chinese Gazebo in Tsarskoe Selo near St. Petersburg, Russia</p>
 <p>Recitation Pavillion in Cang Lang Ting Garden</p>	 <p>Chinese Gazebo on the bridge in Oleksandriia Park, Ukraine</p>
 <p>Free Roaring Pavillion in Liu Yuan Garden</p>	 <p>Chinese Gazebo in Sofiivka Park, Ukraine</p>
 <p>Wutong and Bamboo Pavillion in Zhuozheng Yuan Garden</p>	 <p>Chinese Pavillion in Samchyky, Ukraine</p>

Fig. 5. Comparative analysis of Chinese and European pavillions in the natural environment [Watercolours by P. Chang]

A striking example of the Chinese motifs use in the European interpretation, quite distant from the originals (which is especially noticeable in the image of Chinese men and women) is the "Chinese house" at the residence of Frederick the Great in Sanssouci (architect I. Buring, sculptor I. Benkert). Neither the Chinese name, nor the fantastic robes of Chinese women, nor the interior paintings on the walls and ceiling "on a Chinese theme" create an impression of authenticity, because both the architect and the sculptor, who have never been to China, actually presented the Frederick the Great's courtiers of European appearance in exotic images of the Chinese.

In the Russian Empire, the popularization of the Chinese theme was greatly facilitated by Empress Catherine II, although the fascination with "Chinese" arose in Russia in the early 18th century. The fascination with Orientalism was manifested in the "Chinese" buildings in Oranienbaum – in the Chinese Palace and in 18 Chinese gazebos (dismantled in 1792). The Chinese Palace was built by order of the Empress in 1762–1768 by A. Rinaldi, a recognized master of the Chinoiserie style, and originally until 1774 a one-story building, later added, was called "Dutch house", "house in the Upper Garden", "small house". The name change coincided with a wave of fascination with "Chinese" in architecture, especially since some palaces had appropriate names – Large and Small Chinese offices, Chinese dormitory, and their interiors were decided in the tradition of Orientalism with the inclusion of authentic Chinese and Japanese works of art.

A certain reference to the imperial palaces of China (it is worth mentioning the location on the stylobates of the three main pavillions of the Gugong Palace in Beijing) is the Oranienbaum palace placing on a low stone-clad stylobate terrace, with parterre gardens with openwork fences adjacent from the west and east to the residential rooms.

However, neither the planning nor the orientation of the Chinese Palace in Oranienbaum has anything in common with the planning and orientation of the main pavillions of the Gugong ensemble. Thus, the Chinese Palace is oriented along the west-east axis, the main one is its northern facade, while in Feng Shui, on the contrary, the buildings of the Gugong ensemble are oriented along the north-south axis and the main one is the southern facade. The pavillions of the Gugong ensemble are all rectangular in plan; the Chinese Palace is U-shaped.

In 1778–1786 in Tsarskoe Selo, according to the project of J. Felten (A. Rinaldi?), the famous Chinese, or Creaking, gazebo was built on top of the "Big Whim" (in fact – a park pavilion, where the building is combined into one whole with artificial hill, artificial pond and greenery). Despite the exotic image, the gazebo has no direct analogues in Chinese landscape architecture in the nature of planning, composition, silhouette and morphology of forms, although the tradition of arranging open galleries on the second tier

was widespread in China – as typical authentic examples we should mention the Xingjiao Pavilion in the Summer Imperial Palace in Beijing, Shuangfei Pavilion in Qingyinge Mountain Monastery, Water Gate Pavilion in Tangmo Village, Nostalgia Pavilion in Dujiangyan.

The fascination with the tea ceremony prompted the appearance of "tea houses" in the palace and park ensembles. Later, whole complexes appeared, united under the common name "Chinese Village". The first such oriental settlement appeared in the seventeenth century near Stockholm, as part of the Drottningholm Royal Palace, and later on its model began to appear "Chinese" buildings in other European countries, especially as part of the palace and park complexes. Perhaps the most famous Chinese village was the Chinese Village in Tsarskoye Selo, designed by A. Rinaldi based on an engraving owned by the Empress, where there were houses, Chinese bridges, a stylized pagoda and a Chinese theater next to it, destroyed during World War II and not rebuilt later.

The popularity of Chinese Orientalism continued in the first half of the XIX century, as evidenced by the construction of Chinese gazebos in the estates of "Oleksandriia" in Bila Tserkva (until 1822) and "Sofiivka" in Uman (1841).

Now let's check some European "oriental" buildings on the same indicators. Since the "Chinese" theme in Europe is most often embodied in gazebos, two open gazebos were selected as examples.

The famous "Chinese" (or "Creaking") gazebo in the Tsarskoe Selo near St. Petersburg:

1. location, proportional and metro-rhythmic construction: not subject to a clear orientation around the world, proportionality and metro-rhythmic regularities are not defined by constructive elements;
2. materials: (limited) wooden structures, imitation marble with paintings on the exterior walls, stone, plaster, tin, now – roof of galvanized steel sheets;
3. layout, solution of space and shape: a plan of several rectangular volumes, one of which is accentuated by size and height, the space is surrounded by walls on all sides, flatter simplified and less detailed roof decor (compared to the original samples), several side entrances, windows and entrances of a non-traditional for China simplified form, lack of supporting supports of red color in the lower tier;
4. facade colours: blue (roof, walls), red (roof), yellow, white (decoration details);
5. symbolic images: stylized wooden dragons on the corners of the roof.
6. In addition, the Chinese theme is embodied in non-traditional materials for Ancient China – in Tsarskoe Selo – using wood, limestone, plaster, metal, tin, imitation marble in wall paintings, in Oleksandriia Park – with the use of metal.

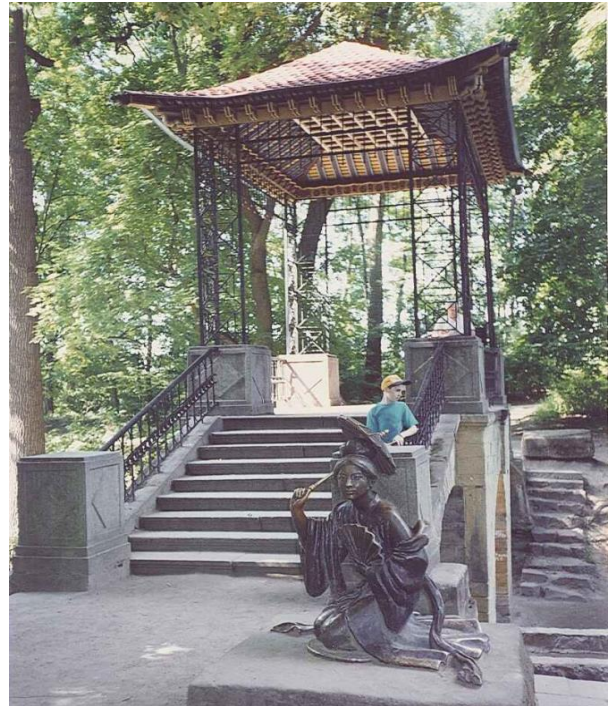


Fig. 6. Gazebo on the bridge in the park "Oleksandriia", bila Tserkva, Ukraine [photo by Yu. Ivashko]

Even "Chinese" sculptures are made in European traditions. That is, in this case, we can talk about the perpetuation of fashion in China, rather than some analogies.

If we talk about the presence of symbolic decor, then in the gazebo in Tsarskoe Selo it is significantly changed, which is noticeable in the images of stylized dragons on the corners of the roof, in the gazebo in Sofiivka decor is almost absent.

The other "Chinese gazebo" in Oleksandriia Park (Fig. 6) is not actually a gazebo, but a dam between two ponds with a gazebo-like superstructure, which performs not only a landscape but also a hydraulic function.

When comparing the Chinese gazebo in Oleksandriia Park with the Chinese pavilions, there is an even greater distance from the original models, despite the fact that it is actually an allusion to one of the oldest types of Chinese pavilions – pavilions on bridges. The load-bearing structures are made of metal, the outline of the roof is even less similar to Chinese roofs, it is monochrome, red, there are no features that characterized the Chinese pavilions – active dynamic roofs, wooden pillars, specific polychrome, paintings, ceramics, etc.

However, since the second half of the nineteenth century, this popularity has declined somewhat against the background of exotic Japanese culture open to the world, and revived in the early twentieth century in some quotes "on the Chinese theme" in painting (K. Somov), in decorative and applied arts of the 1920s–1930s – in household items, theatrical posters, in the decoration of porcelain. In particular, during the Art Deco period, the Hungarian company "Herend"

specialized in reviving the traditions of Chinoiserie style in porcelain.

Chinese ideas of the architecture relationship with the natural environment were rethought in the 1960s in the concept of contextual architecture, which proclaimed its goal to preserve the natural beauty of the site through careful design that relates to its surroundings [23, p.151]. That is, the principles of interaction of an architectural object with the natural environment were applied to organize the interaction of a new architectural object with the already formed artificial, architectural environment. The ideas first expressed by Colin Rowe [9, p. 78 – 79] were further developed in the New Urbanism movement, whose most prominent European representatives include Rob and Leon Krier. Now contextualism emphasizing the integrity of architecture to its surroundings as well as to the intangible culture, history and tradition of a place [14, p. 41] is applied widely in urban planning and design both in the West and in China.

Nowadays, in the context of the ecological crisis, both in China and in Europe, attention has been paid to ancient Chinese landscape traditions as the embodiment of the harmony of the natural environment, artificial environment (architecture) and human. In China, this was expressed in the creation of new botanical gardens and public parks, in the directed education of the population's ecological worldview. In Europe, Chinese philosophical and ideological landscape traditions have not been borrowed, but on the one hand they copy the external forms of "Chinese landscape corners" (there are many such examples in the post-Soviet space), on the other hand, they are looking for their own ways of harmoniously fitting architecture into nature with maximum preservation of the natural environment, including giving small architectural forms bionic outlines and placing them in an untouched natural environment. One of the most extravagant examples is the "Oko nad Brnem (Blob)" ("Eye over Brno (Blob)") – a pavilion of a bus stop in Brno, Czech Republic (architect – Jan Kaplický).

However, it should be noted that modern European designers, as well as landscape architects of the heyday of the Chinoiserie style, mostly focus on small architectural forms, and consider the natural environment only as a background for them. Thus, the main difference between Chinese and European approaches to the interaction of small architectural forms with the natural environment remains.

It is interesting to note that European designers are willing to recognize the value of artificially created, architectural environment, and placing, for example, pavilions of bus stops in the existing urban environment, subordinate new small architectural forms to the architectural environment, using "transparent" glass structures.

The concept of contextualism in architecture, which emerged and developed primarily in the West – in Europe and the United States – is now actively used by

Chinese architects, for example, in renovating the urban design of the historic centre of Beijing [27].

Conclusion

The architecture of Western Europe and Russia has repeatedly been fascinated by Eastern cultures – first, beginning in the late seventeenth century, Chinese, and from the middle of the nineteenth century – and Japanese too. This fascination was stimulated by the intensification of trade and began at the household level, found expression in literature and philosophy, and later in the construction of country residences and garden pavilions in the style of Orientalism, although in a fairly free interpretation of oriental motifs.

The "growth" of Oriental motifs in culture and life at different times manifested itself in different ways and on different scales: mainly, the most massive Chinese and Japanese influences affected the domestic sphere in the form of interior items, accessories and clothing, in addition, showed enthusiasm for philosophical and the religious teachings of the East.

Less commonly, these manifestations took place in the construction of "oriental" palaces, pavilions and gazebos. European "oriental" buildings and small architectural forms only in general terms repeated some of the symbolic elements with which Europeans associated China, in many cases it was more of a name, not supported by features.

Thus, the main difference between the Chinese pavilion and the European pavilion in the Chinese style is that in China the pavilion was based on millennial philosophical, religious and cultural-artistic foundations, which gave each element a hidden meaning, while in Europe it was only an aesthetic whim, fascination with unusual exotics.

The lack of identity between the Chinese and European gardens and the park with the pavilions is proved at the level of planning, a separate object and its element. Two groups of European pavilions of the Chinoiserie style have been identified: pavilions that give a false idea of Chinese architectural traditions ("Chinese Pavilion" in Sanssouci, Pilnitzburg Palace, "Chinese Gazebo" in Oleksandria Park) and pavilions that represent a simplified version of Chinese architectural traditions ("Dragon Pagoda" in Sanssouci, "Chinese Pavilion" in Pilnitz Palace, "Chinese Pavilion" in Tsarskoe Selo, "Chinese Pavilion" in Sofiivka Park).

It is determined that in contrast to the Chinese pavilions, which were built for different segments of the population, the pavilions of the Chinoiserie style became a sign of aristocracy.

Even when European architects sought to embody certain features of the Chinese garden, they approached design from a European standpoint, and this led to a false impression of Chinese culture in general.

Despite the new wave of interest in Chinese culture that is now emerging in both Europe and the West in general, it should be noted that when designing landscape objects, European architects generally continue to consider the natural environment as

a background for compositional accents – small architectural forms.

At the same time, it is impossible not to notice the influence of the traditional Chinese approach to the placement of architectural objects in the natural environment, when the environment dominates the object, on the development of the concept of contextualism in architecture (since the 1960s) which proclaims its purpose to preserve the natural beauty of the site through careful design that relates to its surroundings.

The concept of contextualism is now widely used in the design of small architectural forms in the urban environment and in the design of the architectural environment in general, both in Europe and in China.

Thus, we can talk not only about the influence of Chinese traditional landscape architecture on European practice, but also about the influence of European architectural concepts on the modern practice of architectural design in China. This is a clear example of mutual enrichment with the ideas of two civilizations, each of which preserves its own culture.

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Kopsavilkums. Rakstā analizēta tradicionālās ķīniešu ainavu arhitektūras ietekme uz Eiropas mazo arhitektūras formu veidošanos un Eiropas arhitektūras ietekme uz mūsdienu ķīniešu arhitektūras praksi. Raksta mērķis ir identificēt Ķīnas un Eiropas kultūru arhitektūras savstarpējās ietekmes iezīmes. Tiek izmantota vēsturiskās analīzes metode, salīdzinošās analīzes metode un grafiski analītiskā metode. Identitātes trūkums starp Ķīnas un Eiropas dārziem un parku ar paviljoniem tiek pierādīts dažādos hierarhijas līmeņos. Ir identificētas divas Eiropas *Chinoiserie* stila paviljonu grupas: tās sniedz maldīgu priekšstatu par ķīniešu arhitektūras tradīcijām. Ir pamanīta tradicionālās ķīniešu pieejas ietekme uz arhitektūras objektu izvietojumu dabiskajā vidē uz kontekstuālisma koncepcijas attīstību Rietumu arhitektūrā (kopš pagājušā gadsimta 60. gadiem), kas pasludina tās mērķi saglabāt vietnes dabisko skaistumu, rūpīgi izstrādājot attiecās ar apkārtni. Kontekstuālisma jēdziens tagad tiek plaši izmantots mazo arhitektūras formu projektēšanā pilsētvidē un arhitektūras vides dizainā kopumā gan Eiropā, gan Ķīnā. Tas ir spilgts piemērs savstarpējai bagātināšanai ar divu civilizāciju idejām, no kurām katra saglabā savu kultūru.

Causes and consequences of cultural and historical manor landscape fragmentation in the 19th–21st century Latvia

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Abstract. In the post-war years (50s-80s of the 20th century), the legislation of the Soviet Union defined that the list of monuments to be protected by the state is deemed a political document with ideological significance. Due to this reason, the list of architectural monuments was subject to politically motivated manipulations not only during Stalin's time, but also later.

The political situation after the occupation in 1940 required to adapt to the sovietization demands, didactically dividing cultural monuments into “progressive” and “bourgeois” or those unfit for socialist construction. The history of the cultural heritage protection measures has been related to politics. With the growing importance of cultural heritage in the formation of historical memory, the protection and promotion of monuments becomes an essential part of the ideology of nation states. A change in the state power means a change in the dominant political ideology, which affects the work of state institutions in the protection of cultural heritage.

The research topic has an interdisciplinary nature with the intertwining of political, economic and social aspects. The cultural heritage includes the political dimension and its role in shaping national identity models.

The rise of the Duchy of Courland in the first half of the 18th century made a serious contribution to the landscape of the Lielupe left bank basin in the Zemgale region. The landscape of the both historical ensembles of Svete and Vircava manors was disturbed (fragmented) by the economic and political position of the state. The basis for that was bringing new infrastructure in the nature.

As a result of political, economic and social pressures, the landscapes of cultural and historical manors have, over the centuries, fragmented and transformed the use of the original structure and functional landscape. The aim of the research is to identify and emphasize the causes and consequences of the fragmentation of the cultural and historical landscape of manors.

Keywords: cultural heritage, duchy summer residences, compositional structure, identity, transformation

Introduction

Cultural and historical landscape is only one branch of cultural heritage – its totality consists of multiple layers of heritage of the past that is the value for the entire society at the national level. Upon the contemporary continuous development of the society and spatial environment, the cultural and historical landscape and building structures it incorporates, have not been sufficiently utilized as a potential for a sustainable management, development, and conservation of landscape identity [5].

Every manor ensemble is not only aesthetic, landscape value and remembrance from the past but also one of the socio-economic and representative foundation-stone of the location identity, which a sufficiently large significance is not attributed to – conservation, restoration of the landscape and attaching of new functions to it would correlate with trends of the 21st century [2].

Every manor ensemble had a garden or park, worthy of mention, of which historical significance can be found in about the 18th century. The garden significance has long been a serene and harmonious outdoors often called the paradise where everybody could devote oneself to flight of thought in the environment of silence and nature beauty [7].

However, the current situation does not bear any witness that there was a grand park in the territories of many manor ensembles – two centuries has left considerable transformations.

Problem: As a result of political, economic, and social impact, landscapes of cultural and historical manors, have become fragmented through centuries and their initial structural and functional application has been transformed. *Objective:* To identify and accentuate causes and consequences of manor cultural and historical landscape.

Materials and Methods

Manor garden/park acquires its identity by merging cultures, ages, unique sculpture and architecture locations, human and nature interrelation, and totality of nature formations. Taking account of a political situation and German impact in the territory of Latvia since the 17th century, we can be proud of the number of cultural and historical manor landscapes however, to avert degradation of manors and their parks, a sustainable and adequate economic activity is necessary – tending, restoration and identification of cultural and historical values [4]. The study applies a comparative method – mapping, historical

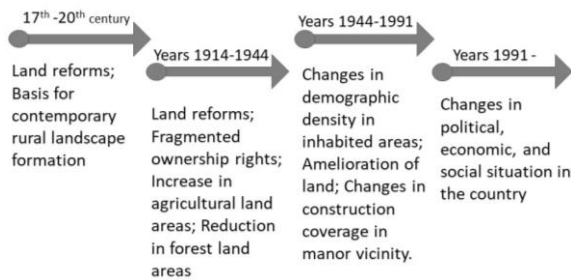


Fig. 1. Landscape genesis scale by authors.
Landscape fragmentation causes [created by authors]

research, collection of field study materials and photographs. Graphical-analytical method is based on representation of graphical material by visualizing the collected information in schemes and collages.

The study scale covers Latvian manor ensembles. Samples in Jelgava area has been analyzed in detail – ensembles of the former Kurzeme duchy: Svēte manor and Vircava manor where traces of different transformations in the cultural and historical landscape are the most typical and obvious. Noting that in the country, in the researched period from the 19th to the 21st century, different political, economic, and social changes have been going on comparatively smoothly, then samples of the aforementioned manor ensembles characterize the situation in general.

Fragmentation causes:

Fragmentation processes of cultural and historical landscape ensembles have considerably impacted the entire Latvian landscape and public understanding of it. Taking into consideration the past rough events, the Latvian nation has undergone, it considerably influences the scale of priorities and values as well as the cultural landscape in general cannot be expressed as a monetary value – it is difficult to grasp what is not comprehensible. This creates an additional burden on landscape and its elements that is reflected in human economic activity – degrading and transforming the landscape. Transformation consequences can be divided into two groups – functional transformation (according to economic activity) and structural transformation (infrastructure, construction, blue-green structure) [2].

Landscape transformation has been considerably influenced by historical events, triggered by political, economic, and social changes all over the world [12; 13].

Figure 1 shows the genesis of the landscape, how various processes in the periods have affected the overall landscape space of the whole of Latvia, especially affecting the manor ensembles. Multiple land reforms have fragmented the ensembles of the original manors - dividing it from 200 ha of property into smaller land units, creating autonomous new farms. In later years, the land was nationalized again

and a collective farm was established – later the consequences of privatization. These are the most important aspects that have divided the cultural heritage and start the degradation of manors. It is important to emphasize that politics, economics and social factors must be seen as a whole - they interact, they allocate separate positions and incorrectly.

17th – 20th century: Land reforms; Basis for contemporary rural landscape formation. Years 1914-1944: Land reforms; Fragmented ownership rights; Increase in agricultural land areas; Reduction in forest land areas. Years 1944–1991: Changes in demographic density in inhabited areas; Amelioration of land; Changes in construction coverage in manor vicinity. Year 1991 till nowadays: Changes in political, economic, and social situation in the country.

The first half of the 20th century is marked by functional transformation causes – economic and political factors. During the Latvian war for independence and WW II a large part of historical buildings was burned down. Today, the current manor management model and the former manor economic function must be revised because mostly it is degrading the identity of a location. It is important to acknowledge that in Latvia the cultural landscape is the value requiring a long-term development and not only an active involvement of branch specialists but also cooperation and education of the public [4].

Manors are mostly situated in vicinity of suburbs or within agricultural landscapes. Structures of construction coverage of rural landscape are impermanent. They change together with the nearest urban development processes that are closely linked to political and socio-economic conditions [8]. Thus, the landscape transformation picture and facilitating factors should not be searched for at local or regional level but at the State and global level. Every landscape – urban, agricultural, cultural, historical, or other should be examined in a general context, without separating them. This is the interrelation in time and space intensified by the aforementioned causes.

Just as sizes of manor buildings have considerably changed their initial architectural value, blue-green structures also play just as significant role in cultural landscapes. Changes in green structures are caused not only by changes in climatic factors in a long-term but also as the result of a thoughtless economic activity. As mentioned before, also in the result of inadequate and unprofessional economic activity of blue-green structures, historical sizes have been considerably disarranged, developing samples of bad practices [6].

In point of fact, the transformation as a process cannot be influenced – the landscape is continuously changing in time and space. However, importance

must be emphasized to research how to eliminate deliberate transformation causes, influenced by human economic activity (Fig. 2). Causes: Transformation processes – Economic functions. Structures. Ecology. Consequences: Political, Economic, Social changes.

Consequences:

Under impact of land reform of the 20th century, in 1920, manors and their lands were expropriated from German landed gentry thus, splitting the territory of manor ensemble among several owners that is one of the transformation consequences of cultural and historical landscape structures. As a result of political events of the 20th century, people were not able to properly evaluate the value of gardens or parks as the cultural and historical recreation space for public. The primary was political and economical factor and not cultural and historical heritage [7].

In the 20th century, a great damage was done by attributing inadequate economic function to manor buildings – they were converted into administrative institutions, schools, hospitals, cultural establishments [7]. Leaving impact not only on architecture of buildings but also considerably transforming territories of the adjoining manor ensembles – new structures were built in their gardens depending on what was situated in the manor, for example, sports field or production facility, community garages and other structures. Svēte and Vircava manor ensembles were split by a highway – such infrastructure elements create disharmony in cultural and historical landscape, posing risk to lose the undivided historical landscape. In the 21st century, a major part of cultural and historical landscapes is in disharmony not only in the context of the manor but also in an overall landscape. Inadequate economic activity is just as damaging as inactivity. Therefore, emphasizing once more that it is important to identify a need to correlate the functional management type of the cultural and historical territories with authentic values of the location in question. The authors' collage (Fig. 3) clearly shows changes in landscape and its elements in the period from the 19th to 21st century. According to structure, to function and to ecology.

Looking at (Table 1) the summer residences of Kurzeme duchy in Svēte and Vircava, it is obvious how building structures have been transformed in the course of time, the overall landscape has been changed, new structures have emerged, a historical layout has changed and according to economic activity the manor landscape has been left fragmented.

The rise of the Duchy of Courland in the first half of the 18th century made a serious contribution

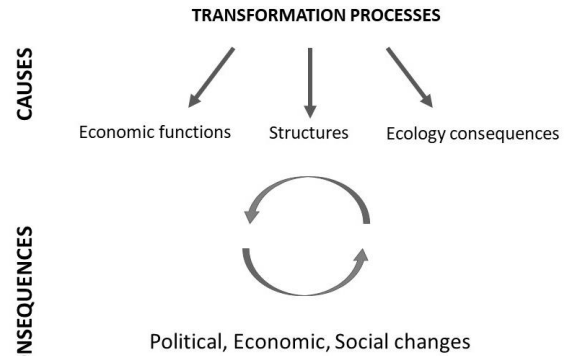


Fig. 2. Figure developed by authors. Interrelation of causes and consequences [created by authors]

to the landscape of the Lielupe left bank basin in the Zemgale region. The compositional structure of the landscapes of both manor ensembles mentioned was disrupted (fragmented) by the economic and political course of the state. The basis for that was bringing new infrastructure in the nature. In the considered examples, the main reason for fragmentation is the construction of the transit road bed – in Vircava Park in the 20s of the 20th century and in Svete Park in the 90s of the 19th century.

These periods have a different political position of the state (the time of the tsarist Russian province and the time of Latvia's independence). Although the political situation in the country is different, the actions in both cases are analogous: not aimed at protecting the values of the cultural landscape. The purpose of political power is characterized by narrow understanding related only to increasing the efficiency of functional significance. Consequently, not only a spatially new structure is introduced, but also the historical quality of the landscape is lost, referring it to the change of the line of sight, which was historically a strict condition. but also to county manors and private manors. These problems and causality are applicable not only to the preservation of the historical values of the duchy (later the province), but also to the manors and private manors. The possibility of recovering the historic park space has been well proven by the works that have been carried out for half a century in Rundale – the most luxurious summer residence of the Duchy.

The other summer residences, in Svete and Vircava, are located nearby – about 10 km by air line. Both of them are linked by a common road that leads to both Rundale and the Green Manor (*Zaļā muiža*), linking them in a circle in the southern part of the Zemgale landscape.

Nowadays, along with the growth of the economic situation in the state, the cultural and historical landscapes of Svete and Vircava have become closer to the scale and the infrastructure of Jelgava urban environment in the course of

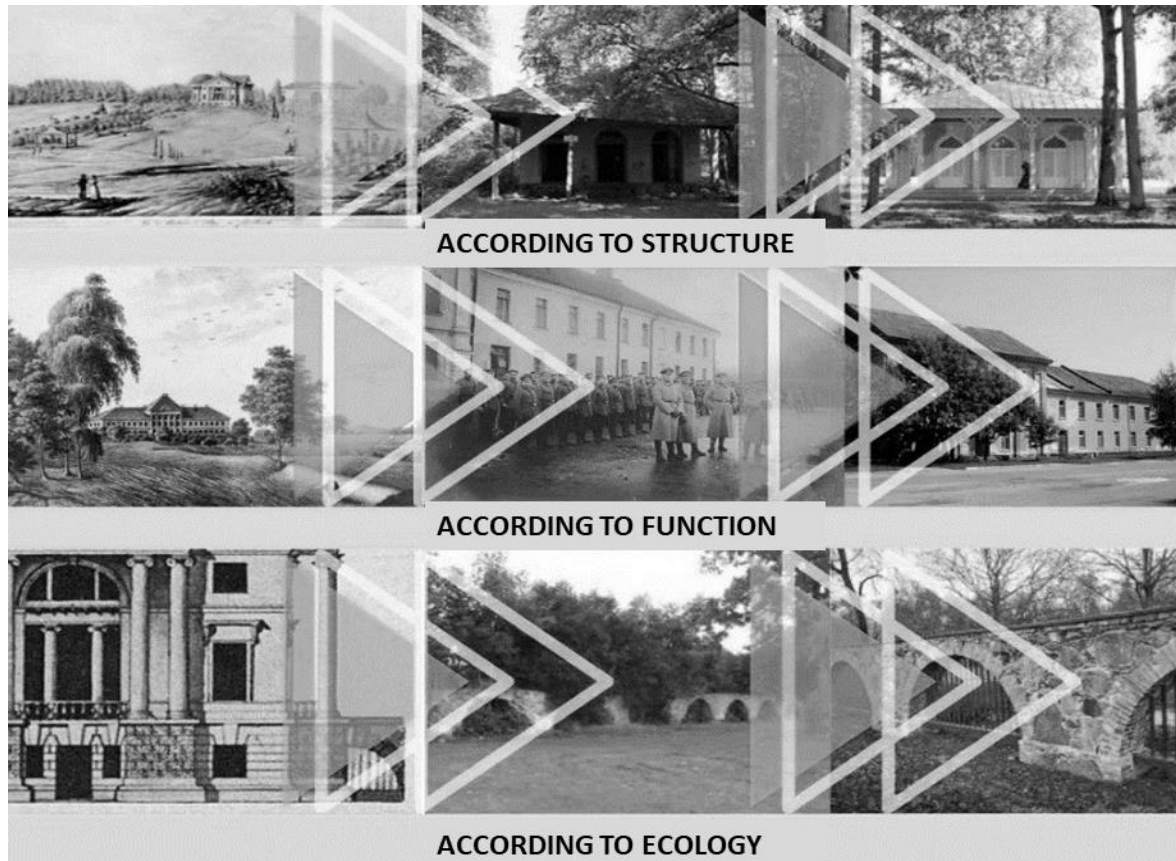


Fig. 3. Transformation consequences of cultural and historical landscape in the period from the 19th to 21st century [created by authors]

250 years (from the first half of the 18th century). After half a century, the suburban residential areas will merge with the manor landscape. Therefore, it is necessary to think not only about the protection zone and building regulation criteria, but also about the state institutions in an interdisciplinary cooperation.

The cultural and historical landscape of Svete and Vircava manors provide a serious opportunity for perspective development of Jelgava urban planning in the next 50 years.

Evaluating the current urban planning situation in Jelgava, the forecast indicates the ring-shaped construction of satellite villages around the current scale of the city. Therefore, it is expected that the cultural landscape of both Vircava and Svete will lose the character of a wide plain landscape with a park, river, floodplain meadows, fields. Longer and shorter lines of view will be formed with the change of the visual and functional character of the medium-distance view, background view and side scenes.

The above said is clearly expressed in the landscape around Svete Castle, where a mansion area with gardens is currently being developed. The adjacent industrial area in the territory of the former park has a temporary nature with contractual obligations. Huge floodplain meadows on the northern side of the castle as a natural base and the

historic dirt road to the castle have been preserved. The same can be said about the geomorphological features, such as gravel hills or the so-called Rullu hills on the eastern side of the castle.

In the context of the perspective development of Jelgava urban planning, blue-green wedge-shaped territories (Fig. 4), which form a unique green recreation in the southern and south-western part of the suburbs, are preserved – a picturesque plain landscape with the fields and forests divided into oblong zones by 4 rivers – Vircava, Eleja, Platone, Svete. They are forming the so-called blue-green wedges in the southern part of Jelgava – in a 10 km wide ring. The distance is also ideal for the development of cycle paths.

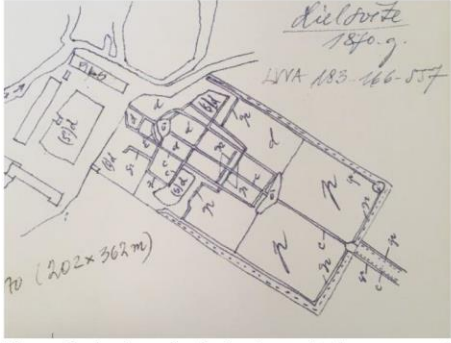




Green-blue wedges formed by forests and rivers in the southern part of Jelgava city space.

Landscape space prognostic around Svete castle ensemble

The floodplain of the Svete river in the northern part of the area of about 40 ha as a natural base will remain and will not disappear. Consequently, the historical view lines across the river from the old existing dirt road to the castle will not be lost either. The situation is more complicated in the southern part of the castle, where slums have formed in the territory of the post-war old park. The production

TABLE 1

Comparison of the Duchy of Courland in Svēte and Vircava in the 19th and 21st centuries [created by authors]

19TH CENTURY		
	VIRCAVA MANOR ENSEMBLE	SVĒTE MANOR ENSEMBLE
IMAGE		
CHARACTERISTICS	The main dominant in the landscape is the manor and its buildings. Highly atypical, admirable garden layout over the Vircava river with water partitioning system. Distant vista lines, alleys, and typical French garden elements. Agricultural landscape is surrounding.	The main dominant in the landscape is the manor and its buildings, particularly notable by its orangery. A large garden with several areas. Distant vista lines, alleys, and typical French garden elements. Surrounding agricultural landscape, the river flows along the manor.
21ST CENTURY		
CHARACTERISTICS	  	  
CHARACTERISTICS	Historical garden composition has been deranged by splitting it up and constructing the highway. As a result of amelioration, part of the green structure is bogged up, overgrown and vista line have disappeared. In the other part of the park, some historical alleys and water partitioning have remained but in the middle part, an artificial plot has been arranged where a sports field is situated. Manor house is in a critical condition. Some fragments of the former buildings have remained. The cultural and historical landscape is surrounded with agricultural landscape. Village buildings are situated by the manor perimeter. These are mainly private houses, which do not compete with the size of manor.	The historical garden composition has been considerably deranged by splitting up the cultural and historical landscape. The highway separates the manor buildings from historical part of the garden where currently various types of buildings are situated – private houses and production facilities. There is an unused sports field, occupying part of the garden. Part of perimeter plantings have remained that gives a notion about the scale of the garden. The manor house ensemble is in a critical condition. The major building is being restored, other buildings have been demolished or partly in ruins. Also, in this area production buildings are very closely placed. There is an apartment building built in front of the manor and it dominates the manor and covers it up. Taking into consideration that the manor is situated on a bank of the Svete river there are flood-lands on the other bank of the river, retaining vast and distant vista lines. Whereas, from the collective-farm times, there are private buildings and remains of the military buildings in the manor garden.

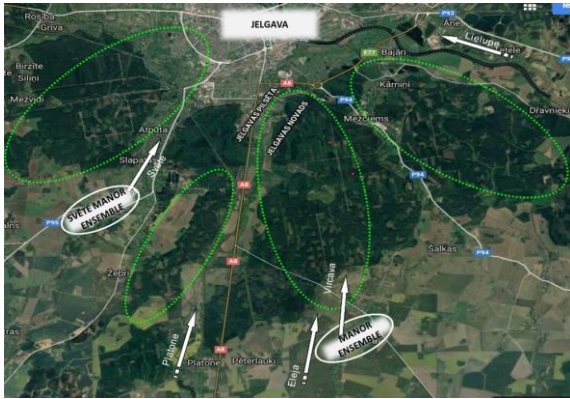


Fig. 4. Green-blue wedges formed by forests and rivers in the southern part of Jelgava city space [created by authors]

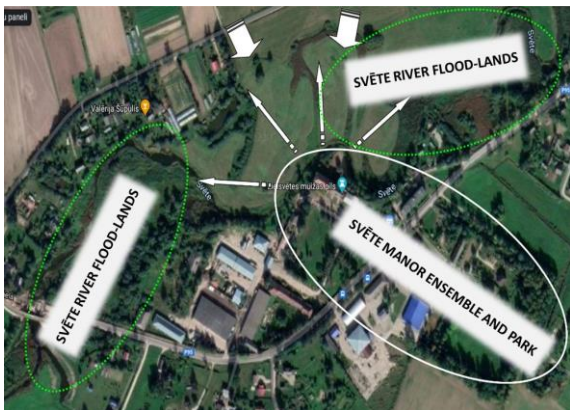


Fig. 5. Research of fragmentation of Svete manor landscape [created by authors]

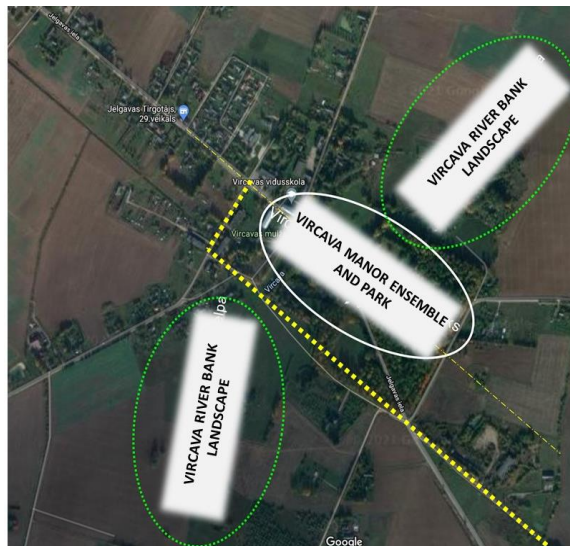


Fig. 6. Research of fragmentation of Vircava manor landscape [created by authors]

areas are being eliminated, recovering the historic park area and the approx. 100 m long alley of lost tree plantations in the southern part of the park. The same as Vircava Park, Svete Park was surrounded by a tree alley and a canal or ditch system, which formed a compositionally enclosed park space.

By dismantling the giant warehouse in the south-western part of the castle, it is possible to reclaim the

second floodplain area of the river with distant lines of sight. This will enclose the cultural space of the castle in a 180 degrees wide radial band (Fig. 5).

On the eastern side of the park, the park's longitudinal (Parka iela) or the old dirt road leading to the Vircava manor ensemble past the roadside pub "Lapas" and the burial area belonging to Vircava manor (Poķu kapi) has been preserved.

Landscape space prognostic around Vircava castle ensemble

The manor house of Vircava manor was destroyed during the World War I. Only some manor houses have been preserved. The territory of the southern part of the park with the old tree alleys is still luxurious. The northern part of the park is more deserted. To eliminate the fragmentation of the park and to restore the historical situation, it is necessary to restore the old dirt road along the south-western edge of the park.

In the eastern and the western part of the park, the landscape of the banks of the Vircava river is very picturesque. The river forms steep banks in the castle area, with river meadows or floodplains attaching to it in the lower and upper reaches of the river.

The above mentioned forecast for the development of urban space in the south-western direction is possible upstream the left bank of the Vircava river, with the lengthening of the administrative boundary of the city. This will partially include the above mentioned suburban forest park area, if we look at Fig. 6.

Legislation

The financial aspect is a considerable factor in rehabilitation of cultural and historical landscapes. This is a great burden for owners. Thanks to different support programs, restoration of manor houses is facilitated but it is not enough. Major part of manor owners lacks adequate funding to maintain or renovate the ancient pearl of culture. It is possible that ownership rights should be revised and the properties whose owners are not able to maintain should be alienated by the State or the Culture Fund. Although the most of cultural and historical landscapes in Latvia are in critical condition, they find young and entrepreneurial owners who take an active part in social live, popularizing the manor and its history, strengthening identity of the location, making projects and facilitate the development of the location.

Planning of landscapes, including cultural and historical landscapes is carried out at different scales: (Regulations on territory uses and construction coverage; Thematic planning of landscapes etc.).

- Internationally (European Landscape Convention);

- At national level (Latvian landscape policy guidelines; Cultural and political, etc.);
- At the level of Planning regions (Strategies, etc.);
- At the level of local governments.

To conserve a unique nature, cultural and historical landscapes, typical for Latvia and, which constitute prerequisites for ensuring of quality living environment for population, the following must be done [1]:

- The State support must be ensured for multifunctional and productive rural territories for conservation and formation of the cultural landscape;
- Landscapes, unique and typical for Latvia must be identified, their inventory must be carried out and proposals must be worked out for landscape management and monitoring of processes;
- The public must be educated and involved in landscape management;
- The territory plans must lay down requirements and conditions, providing for protection of locations, significant in term of the landscape.

A very good example, allowing to avoid development of dominants and competing structures close to cultural and historical landscapes, are the thematic planning of landscapes by local governments. Unfortunately, only some local governments have developed such plans, for example, it is laid down in Rundāle area that tree planting is prohibited if they obstruct open view to cultural and historic objects [1].

Regarding historical parks, considered as such are the territories older than 50 years. It is laid down that construction projects must be developed for the entire territory, without allowing a further fragmentation of land units there, as well as considering the nature of cultural and historical environment, planning structure, diversity of species and details of the landscape architecture. In case the park, its part or an object is a cultural monument, protected by the State, upon developing a construction project for enlarging (reconstruction), restoration or renovation, the conditions laid down by the National Cultural Heritage Board must be complied with. If the historical park that is the State protected cultural monument has been laid out according to a specific historical plan or project or a detailed design has been approved for it, establishing park's status according to these regulations is possible without the construction project, at one time, the park is laid out according to construction regulatory acts and the park construction project can be developed according to procedure of general construction regulations [10].

If the status of cultural monument has been applied to the park under this law, then economic activity is also regulated there. Just as it is laid down that a park owner or manager is obliged to ensure its

conservation and in case some changes are intended, they must be coordinated with the National Cultural Heritage Board. Also, if some damages have been caused to the cultural monument, the aforementioned authority must be notified. It is necessary to enable competent authorities to timely assess the impact of damages and how substantial they are, providing a possible solution to elimination of the damage or its restriction. Within the cultural monuments both economic and other activity is limited. Around cultural monuments, which protection zone has not been determined for and newly-found cultural monuments in rural inhabited areas, the protected zone is 500 meters but in towns – at the distance of 100 meters. Within the protected zones around cultural monuments, activities affecting the cultural and historic environment (for example, construction, artificial transformation of soil surface, forestry activities, lifting from water or unearthing of such prior unidentified items, which possibly could be of a historic, scientific, artistic, or other cultural value) are allowed only on a written permit from the National Cultural Heritage Board. For cultural monuments, which do not need the protected zone at the distance provided by the law, the National Cultural Heritage Board, upon cooperation with the local government, may reduce this distance. In case extension of the protected zone is needed, then the Board lays down it according to the procedure provided by the Cabinet of Ministers [11].

Unfortunately, upon getting acquainted with the legislation and inspecting cultural and historic landscapes in real life, a consistent implementation of this law has not been observed, which has led to destruction of the manor cultural and historic landscape. It is very easy to ruin historic values, but their recovery is time-consuming and financially hard...Neither replication compensates the original architecture or any other landscape element.

In the post-war years (50s-80s of the 20th century) In the post-war years, the legislation of the Soviet Union defined that the list of monuments to be protected by the state is deemed a political document with ideological significance. Due to this reason, the list of architectural monuments was subject to politically motivated manipulations not only during Stalin's time, but also later [3].

The political situation after the occupation in 1940 required to adapt to the sovietization demands, didactically dividing cultural monuments into “progressive” and “bourgeois” or those unfit for socialist construction.

The research topic has an interdisciplinary nature with the intertwining of political, economic and social aspects. The cultural heritage includes the

political dimension and its role in shaping national identity models.

The connection between the historical science and the field of cultural heritage protection is manifested at 3 main levels:

- History and the preservation of its material evidence is the main object and purpose of the preservation of the cultural landscape;
- The activities of protecting the cultural landscape is a historical phenomenon and forms the result of certain social processes;
- The protection of monuments interprets and changes history and its perception in by the society.

Awareness of history, which is sometimes called 'cultural memory' or 'social memory', refers to the society's conventional concepts of the past that are intended to provide a meaningful explanation of historical experience. The awareness of history gives the past its meaning and value [9].

The history of the cultural heritage protection measures has been related to politics. With the growing importance of cultural heritage in the formation of historical memory, the protection and promotion of monuments becomes an essential part of the ideology of nation states. A change in the state power means a change in the dominant political ideology, which affects the work of state institutions in the protection of cultural heritage.

During the Soviet era, Latvian rural manors were mostly included in the so-called "c" category architectural monuments, which could be used for economic purposes (for the needs of collective farms and state farms (kolkhozs) – farms, mechanical workshops, warehouses for grain, building materials, technical parts etc.) [9].

The promotion of the new Soviet state and the development of grain farming in the newly established sovkhozes and kolkhozes was also extended to manor houses, including the duchy's summer residences. For example, in the 50s of the 20th century, in Rundale Golden Hall, parquet floors were used to dry freshly harvested grain in the autumn, which was ensured by ventilation and air volume of the room – opening the wide windows of the hall on both sides of the room and high ceilings. This way, the state's political order and the state's economic development, which was built on the pillars of the cultural environment, were going hand-in-hand.

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Conclusions

1. Cultural and historic landscape has an essential role in an overall image of the location and strengthening of its identity, it can become a significant stimulus for economic growth, also promoting a flow of tourists and economic prosperity.
2. Transformation process is essentially unavoidable. It is important to understand interrelation of causes and consequences, to avoid inconsiderate decisions, which deliberately endanger values of cultural and historic landscapes.
3. In the 20th century, reconstruction of parks experiences its recurrent renaissance. Although this process currently is of a particular importance, still it is necessary to educate the larger public on the significance of cultural and historic landscapes.
4. It is necessary to develop a specialized and allowed use of territories in protected zones of cultural and historic landscapes to avoid identity degradation of a location and competition of dominants.
5. The summer residences of Kurzeme duchy in Svēte and Vircava have lost their historic identity, in the course of recurring inadequate transformation processes, including economic activity. It is important to find harmony between values of cultural and historic landscapes and contemporary economic function within them.
6. Along with the cultural environment, the pulsating urban planning infrastructure and its development rates are strongly approaching the cultural and historical territories of the outskirts. Although protection zones and lanes around the cultural space will be preserved, it will bring a new scale and pulsation of infrastructure.
7. Cultural and historical building volumes form the smallest part of the fragmentation of cultural heritage in the landscape space. In terms of scale, the part of the manor park is larger and its fragmentation is noticeable. Therefore, it is necessary to recover both the axes of the compositional structure of the cultural space and the dominant points of the axes.

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Kopsavilkums. Pētījuma tēma ir starpdisciplināra rakstura, kurā savijas politiskie, ekonomiskie un sociālie aspekti. Kultūrmantojums ietver politisko dimensiju un tās lomu nacionālās identitātes modeļu veidošanā. Kurzemes hercogistes uzplaukums 18.gs. pirmajā pusē ir devis nopietnu pienesumu Zemgales reģiona Lielupes kreisā krasta baseina ainavtelpai. Abu vēsturisko, Svētes un Vircavas, muižu ansambļu ainavu ir izjaukusi (sadrumstalojusi) valsts ekonomiski politiskā nostādne. Tās pamatā – jaunas infrastruktūras rakstura ienešana. Politisko, ekonomisko un sociālo slodžu rezultātā kultūrvēsturisko muižu ainavtelpas, gadsimtiem ejot, ir sadrumstalotas un transformētas to sākotnējās struktūras un funkcionālais ainavtelpas pielietojums. Pētījuma mērķis ir apzināt un akcentēt muižu kultūrvēsturiskās ainavtelpas sadrumstalotības cēloņus un sekas.

Chinese pavilions in the early landscape gardens of Europe

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Abstract. The image of China perceived by the Europeans in the 17th to 18th century was based on the travelogues of the travellers and missionaries. Despite the fact that the first descriptions did not include any pictures of the world, people and landscapes described, the far exotic country with its history and tangible heritage became very popular. This article deals with Chinese pavilions (pagodas, teahouses) built in the early European landscape gardens before 1750 without any architectural plans, using only sketches based on descriptions and travelogues, since in the first half of the 18th century, no relevant technical guidance was available yet. The structures reviewed started to be used frequently in European gardens and public parks from 1750's, having an inevitable influence on the garden pavilions built from the second half of the 18th century, and indirectly to the image and character of some influential gardens in European context. Moreover, through their craggy appearance, the Chinese pavilions – as eye catchers – played an accentuated compositional and spatial role too in the European garden history.

Keywords: spatial composition, historic landscape garden, Chinese building

Introduction

In the modern period, parks played a significant role in the introduction of distant countries and cultures. Playing a leading role in the development of the European garden culture, England was the home of the most inspirations originating from the Far East (India and China). Through the English Garden, the exotic shapes and features of the Far Eastern architecture then appeared and spread all over Continental Europe in the 18th century as important symbolic elements of garden decoration [15].

The goal of the research is the review of Chinese style pavilions and other garden structures in European gardens from the first half to the middle of the 18th century, according to their location, function and role in the spatial composition in the garden. The Chinese garden features played an important role in the development of European Landscape Gardens and parks. Such features – beside their functionality – had a considerable educational contribution, being windows for Europeans to exotic worlds and cultures. As far as the design of public parks in Europe evolved in the second part of 18th century, the built elements of the Chinese gardens introduced in the European garden Culture in the first part of the 18th century served also as examples for public parks in Europe. Reflecting architectural and artistic trends of specific time periods and eras, and design concepts of various ideologies, through their images, compositional aspects and symbols these features – especially the pavilions, pagodas and tea houses – also fulfill an important educational role in everyday life. Just like in Chinese landscape painting, views of the surrounding landscape might had also played

an important role for the location of garden pavilions. Thus the research also deals with the views and garden scenery provided for the visitors of the pavilions. At the same time, the role of the pavilions and other Chinese garden structures played in the spatial composition (their location and views from various directions) is also a subject of the research, demonstrating that these structures were also deliberately used as eye-catchers and focal elements of the composition.

Material and Methods

Places and instances selected for the study represent the early period of landscape gardens (before 1750), when professional descriptions of the design of Chinese pavilions and structures were not yet available. The work of William Halfpenny [18], in which the Chinese style appears in mix with the Gothic, may already be considered as such a professional work, as well as the more demanding work of William Chambers [6]. The selected sources are early descriptions of European travelers, mentioning and depicting some compositional, functional and structural elements and features of Chinese gardens. The authors are professionals belonging to other disciplines (for instance Boyd, Kircher) or travelers and missionaries (de Mendoza, da Cruz,) as we discuss and mention their works in the chapter “Results and Discussions”.

In the first half of the article, we focus on the image of China evolved from the written travelogues and graphical illustrations published in Europe. Works of the most renown Jesuit missionaries, scientists and travellers provide the primary basis for the research. Writings from English authors follow



Fig. 1a–1b. The Porcelain Tower and the Pagoda [Nieuhoff, 1665]

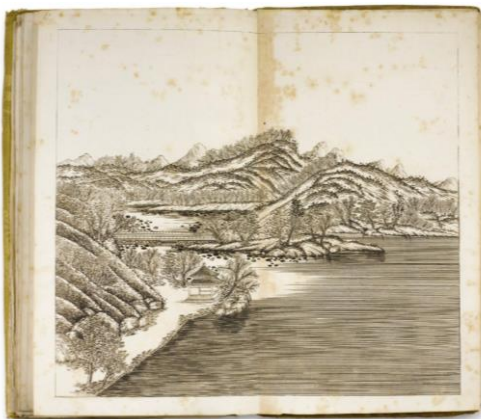


Fig. 2. The summer palace of the emperor in Jehol, details, 1713, Matteo Ripa [Dumbarton Oaks]



Fig. 3. The Chinese House [Seeley, 1750]

then, which were influential on the appearance of Chinese structures in the gardens of England. The second part of the article includes case studies on specific gardens. Based on the analysis of layouts, maps and other illustrations and descriptions available, we interpret the role of the Chinese elements appeared in European gardens, and the effects of the pavilions.

Results and Discussion

Although China is one of the ancient civilizations of the world, except for the 13th century travel of Marco Polo, it was only in the end of the 16th century when detailed descriptions of China appeared in Europe.

In 1585, with the support of the Church, the Portuguese monk, Juan Gonzales de Mendoza wrote his comprehensive and detailed book on China, titled *Historia de las cosas mas notables, ritos y costumbres del gran reyno de la China*. Three years later, the English translation of the book was a great success all over Europe. Mendoza based his book primarily on the work of Gaspar da Cruz [10], which described his own and other travellers' experiences, along with descriptions from several additional Spanish and Portuguese travellers, merchants, Jesuit monks, mostly without naming the actual source [22]. Regarding its topic, the book discussed the geographic location and the climate of China, the Chinese people and products, the early Chinese history, the organization of the provinces, the cities, roads and the miracles of architecture, religion, wedding and burial rituals, donations and moral and religious issues. It is important to highlight that Mendoza was the first who integrated the information from various sources into a single, comprehensive description. According to the description in the book, homes were spacious and included everything what people needed: gardens, orchards, fishponds with adjacent dining places, parks and groves, flying birds, fish and game which are also present in the hills and the rivers. All these were fenced with a stone wall, just like in a town. People were relaxing, listening to music and amusing themselves. It is notable that even prisons had fishponds, gardens and courtyards, where prisoners could take a walk and refresh themselves [28]. It was Mendoza's book where the word pagoda first appeared as a reference to a multi-storey tower. According to its etymology, in Chinese the word literally means an octagonal tower [43].

After the middle of the 17th century, various Jesuit missionaries summarized the knowledge gained since the publication of the earlier works. The Portuguese Semedo wrote a comprehensive work on China [35], the Polish Boym prepared an illustrated publication on the flora of China [4], and the work of the Italian Martini, who prepared the

map of the 16 provinces of China with explanations, also worth mentioning [25]. At the same time when Martini prepared his map, in 1655, the book of the Dutch traveller, Johan Nieuhoff, was also published with the title *L'ambassade de la Compagnie Orientale des Provinces Unies*. Unlike the previous works, it was richly illustrated with etchings of landscape details with pagodas and buildings. One of its most renowned etchings was the porcelain pagoda of Nanking, which became one of the exemplary patterns of the later pagoda constructions in Europe.

The pictures in the book depict mostly riverside towns and landscapes with the very buildings that could have been the sources of inspiration for the appearance of pavilions in Europe (Fig. 1a, 1b).

During the research, we noticed that the captions of the pictures were not always unambiguous. In the original Dutch work, the captions of Figures 1b include the word „pagoode”, which was translated as “temple”. We believe that this is an appropriate interpretation, since pagodas are usually multi-storey, tower-like structures that make part of a Buddhist temple complex.

At the same time, the pagoda-like structure on Fig. 1a described as the “porcelain touren” was named as “tower”, probably due to its height. Since for Nieuhoff it was not obvious how to name each feature, we assume that a standard terminology of the subject had not evolved yet until the beginning of the 18th century.

In his writing, Nieuhoff also describes the details of a feast. Singing and instrumental music was performed during the party for entertainment. Before the dinner, the guests had a walk in the garden, deliberately for the purpose of refreshment, until the servant invited them to the table. Elsewhere, he depicts a praiseworthy beautiful historic garden behind a temple, where the narrow walkways are covered with golden sand and flanked by rare tree specimens, and flowerbeds are a delight for the eyes with thousands of flowers. He is among the first to write about cliffs and artificial mounds, prepared with a special care so that art seems to exceed nature. Inside the artificial mounds and cliffs, caves, rest rooms and parlours provide refuge from the summer heat, for the refreshment and mental pleasure of the visitors. People feel really good in these grottos, and the educated prefer to study here than anywhere else. Writing about the buildings, he highlights that they are not very durable, built of wood without a foundation, and in a short time they require daily care in order to prevent them falling into decay [31].

Athanasius Kircher was a Jesuit scientist, one of the most renowned natural scientists of the 17th century, and also of the last polyhistor of the Renaissance. As a teacher at the Collegio

Romano in Rome, he had many supporters and a broad network of contacts for accessing several Jesuit travelogues on China. He used and synthesized these travelogues for writing his book titled *China Illustrata* published in 1667, which was a summary of the 17th-century European knowledge of the Chinese Empire and the neighbouring countries. It is unusual that, on the basis of the descriptions, he depicts the Porcelain Pagoda as an octagonal tower. We may consider this a caricature, since none of the other illustrations show the pagodas so angular. Several etchings in Kircher's book show structures, buildings, pagodas in the background. This indicates that he already had some ideas about the appearance of pagodas and buildings. In the geographical description, he mentions that the letters of the word China mean “Central Empire”, “Central Garden” or “Flower Garden” for the Chinese, as a reference to the abundance of the assets that are necessary for human life. He writes about rivers streaming from the Western mountains, lakes and rivers feeding agricultural land, leaving none of them dry. Almost all the towns have rivers and connecting canals suitable for shipping, fostering commerce. In Chapter 6, he introduces exotic Chinese plants with illustrations. The illustrations are rather peculiar: some of the pictures, which depict the plants in the context of the landscape show pagodas and other Chinese structures in the background [20].

Domingo Fernández Navarrete Spanish missionary and archbishop writes about history, politics, morals and religion in his book published in 1676. One can read about the image of China described by Kircher also as: “a majestic, flourishing empire, a garden, a grove or a marvellous place in the middle of the world”. The garden appears also as a metaphor in the moral lessons: if one lives a proper life, one is just like the plant in the spring garden, growing imperceptibly every single day. A specific example on the deliberately focused view also appears: Prince Sui made up his mind to have a tower built in order to renew the view on the woodlands. In the same text, the relationship of the ship and the water is used to describe the relationship of the emperor and the people, with a remark that one can use the good metaphors for one's own benefit. If we are a ship, and our environment is the water, then without the environment we cannot travel. But still we start the ship travel! Let us have gardens, houses for entertainment, waterworks, high towers, richly decorated uniforms, feasts of the bull, games, horse riding and other pastimes. I allow all these, but first take a look at your properties, lands and kingdoms, check the depth of the water, and see how deep it is. Look at the villages destroyed and the towns abandoned, see the misery of your matters,

and you will be sure that the amount of water is not sufficient for the ship travel [30].

As a diplomat, Sir William Temple travelled all across Europe, then he became a Member of the Irish Parliament, but due to a political decision later he decided to withdraw from the public sphere. Leaving his London house behind, he moved to the countryside. In 1685, he wrote his essay about gardens in Farham, presumably based on stories heard during his European mission, which had a substantial influence on the thinking of the period. He introduced the concept of “sharawagdi”, which then equalled to querying the exclusiveness of the European ideal of beauty. The Chinese disregard such forms of beauty based on symmetry or specific ratio, and give preference to grand size in beauty, which attracts the eyes without any order or composition that are easy to take notice of [41]. Researchers still search for the meaning and origin of this word up to this day [29], since it is clear that it is not of Chinese origin, but probably of Japanese. In his writing from 2013, Kuitert [21] makes a reference to the wryness of the Far Eastern kimono, which is described by the Japanese with a word similar to “sharawagdi”.

In his travelogue, Louis le Comte, a French Jesuit monk who travelled to China at the behest of Louis XIV in 1687, describes the gardens similarly to Nieuhoff. After the meal, they withdrew into the garden, then shortly continued with the dessert. Out of the buildings, he highlights the pagodas and the temples, the water reservoirs that retain the water streaming from the mountains, the gardens, groves, and the sheltering grottos in the cliffs. The temples consisted partly of halls, of rooms and of pavilions standing at the corners of the courtyard [23].

Between 1711 and 1723 Matteo Ripa, an Italian monk worked in the Chinese Court as a missionary. Based on 36 Chinese paintings, he prepared copper etchings of the Jehol residence of the emperor, which he introduced in London in 1724 to the distinguished members of the “Court of St. James”, along with the map of China (Fig. 2). Later, the etchings appeared at the Chiswick residence of Lord Burlington published in a book [17].

Du Halde, a French Jesuit priest was the trustee of the collection of reports sent by missionaries from China. In 1735, he synthesized the documents about China in four volumes, according to geographical, historical, chronological, political and other aspects. None of them included any landscape illustrations. It made a significant impact on the thinkers of the age. According to Voltaire, despite the fact that it was written in Paris and he (Du Halde) did not speak Chinese, the volumes provided the most comprehensive and the most excellent description of the Chinese Empire worldwide.

As Du Halde wrote: one can see gardens, woodlands, ponds, and everything that is an eyesore – some even created artificial cliffs and mounds full of bends just like in a labyrinth in order to have fresh air [13].

The French Jesuit, Jean-Dennis Attiret travelled to China in 1737 as a painter. A book compiled of his letters was published in London in 1752. Regarding the aesthetic value, he found the Beijing Palace with its buildings for entertainment and all the other features magnificent and marvellous, both in design and realization. That is how he described the landscape: “*They go from on one of Valleys to another, not by formal strait Walks as in Europe; but by various Turnings and Windings, adorn’d on the Sides with little Pavilions and charming Grottos: and each of these Valleys is diversify’d from all the rest, both by their manner of laying out the Ground, and in the Structure and Disposition of its Buildings.*” Nevertheless, for the buildings of amusement they prefer to choose the „*beautiful irregularity*”, and set aside the artistic principles as much as possible. The translator includes a special note here that, according to the printed images he saw, the appearance Attiret attributes to the buildings is controversial, since the buildings themselves are regular, while everything else around is arranged irregularly. Elsewhere he mentioned the openness of the pavilions in order to provide fresh air to breathe. Reading the early descriptions, it is not difficult to imagine the curiosity and enthusiasm arose amongst the Europeans about the exotic world of the Far East. The first descriptions were text only, and it was only in the middle of the 17th century that rich illustrations about landscapes, buildings and people appeared in the book of the Dutch traveller, Nieuhoff. Later, painters and Jesuit artists also participated the missionary work, and that is how additional pictures of landscapes, which were not related to any travelogues or descriptions, appeared in Europe [3].

The emergence of Chinese garden pavilions in Europe

The unanimous admiration of China as well as the availability of products supplying this demand were the basis for the emergence of the Chinese pavilions in the gardens of Europe. Chinese rooms appeared in several palaces, or dressing rooms where Chinese furniture, paintings, sculptures, porcelains and other decorations were applied in a Chinese corner, serving as a kind of jewelry box.

Chinese features were soon introduced also in the open grounds. The French Trianon de Porcelaine was the first “chinoiserie” building in Europe, built by the order of Louis XIV in the Park of Versailles in 1670. Inspired by the short-lived Porcelain Pagoda, the building was rather European in its

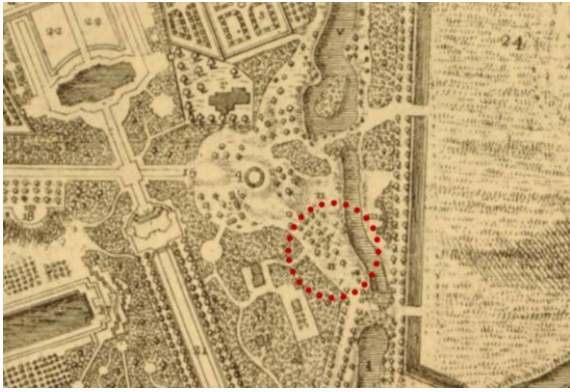


Fig. 4. The highlighted area shows the location of the Elysian Fields on the 1739 layout of the Stowe Park. The map does not indicate any buildings at the place mentioned in the descriptions [material from authors private archive]

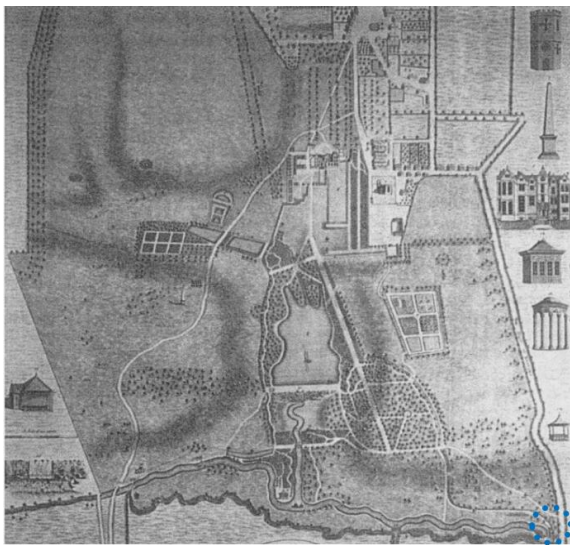


Fig. 5. The layout of Wroxton Abbey, etching by Francis Booth, ca. 1750 (Meir, 1997). The circles indicate the look and the location of the Chinese House (red) and the Chinese Pavilion (blue) [material from authors private archive]

style, still the use of the white and blue porcelains gave it a special Chinese flavour.

Between 1720 and 1725, Frederick Augustus II, Elector of Saxony, had a summer palace built at the Elb in Pillnitz, specifically for the purpose of riverside feasts. In addition to the Baroque style of the palace, an oriental character was provided by the Chinese style roof. In the case of both examples, the form of the building targets the spectator, while the content within the form is a reference to the place of joy and feast known from the descriptions of China.

Herebelow, we review some classical sites that have a great relevance to the topic discussed.

Stowe

It was thanks to Lord Cobham that the first explicitly Chinese house was built in England. From 1738, it was located in the Stowe Park, originally standing on piles in the middle of the pond east from the already existing "Elysian Fields". The design is of the architect William Kent, while the decorations

were prepared by the Italian Francesco Sletter (Fig. 3). It is not marked on the 1739 map of Sarah Bridgeman (Fig. 4) [1], while a map prepared in 1742 by an unknown author displays it as the Indian House. We have found only references to the 1742 map, but we could not find the map itself. Nevertheless, the "Indian House" may be identical with the house described by Robert Bachelor in the quote above, since Chinese and Indian buildings and motifs are often mixed up in the descriptions from the age concerned [7]. Chinese inscriptions quoted from a Taoist work from the 4th century were decorating the house, which, at first look, had a special European style. Their master probably used the 18th image of the 1757 book of Chambers as an exemplary pattern. According to De Bruijn, it is doubt that the artist understood the philosophical meaning of the text, since Chambers himself also tried to find out the meaning and the source, without any success [5]. Benton Seeley also describes the house in his travelogue in 1750: "A bridge decorated with Chinese vases full of flowers provide access to the Chinese House on the pond. The four lattice windows are covered with bunting in order to preserve the light of the paintings. Inside, a Chinese lady as if she were sleeping, with her arms covered by her clothes. On the pond, two Chinese birds (of the size of a duck) are moved by the wind as if they were living" [34].

The location of the pavilion and its relationship with the Elysian Fields is rather talkative. As special historic references, The Temple of British Worthies and The Temple of Ancient Virtue intensify the significance of the tiny house. The Chinese House may be related to the moral content of the descriptions about China, the moral lessons from Confucius, setting the paragon of the Chinese hierarchy and the virtuous approach to carrier against the corrupt image of the political life in England. Since the space is full of political references, the House also takes this type of role. In 1751, the House was moved to the Wotton House Estate until 1957, then to Ireland until 1993. It has returned to Stowe in 1998 renewed.

We cannot find the Chinese pavilion on the 1750 map [2], and the legend does not include any reference to such building (or to an Indian House). Today, the Chinese pavilion has a completely different location; the Elysian Fields and the related water surface are empty.

Wroxton

According to written records, it was 1739 when the construction of the Chinese House, the open pavilion and the bridge started in Wroxton Abbey. Horace Walpole reckons these as the first Chinese structures appeared in Britain. [24]. The Chinese House was located at the tiny peninsula embraced by

Sor Creek. As the maps and illustrations from 1750, 1887 and nowadays show, the peninsula was the farthermost spot from the entrance of the estate and the main building, towards the direction of the fishpond (Fig. 5) [27].

On the picture of Mary Delany from 1754 titled *The Indian House*, the structure and the handrail pattern of the Chinese Bridge are also possible to observe (Fig. 6a) [11]. In the northern part of the estate, where the Drayton Road crossed the Sor Creek, a Chinese Pavilion was located, with a small pond in the foreground, providing a view on the valley of the creek (Fig. 6b) [12]. In addition to entertainment, it served also as a visual feature for those travelling from Banbury to Wroxton.

On the basis of the work Du Halde wrote about China, Chinese structures and garden elements were associated with the desire of returning to and celebrating the beauties of Nature, but also with the relaxation and entertainment described. His letter written to Lord North Miller is also an evidence of this, inviting the landscape architect into the Chinese House for a pleasant recreation, with cold meat and ice cream served, and warm enough indoor to avoid getting cold [27]. The location and the appearance of the Chinese House and the Pavilion may be related to the etchings of Nieuhoff and Ripa about riverside landscapes, by the design of the human structures in the characteristically depicted landscapes, and also by the view of the stand-alone tiny pavilions on the riverside or the top of a cliff.

Studley Royal (Water Garden)

Studley Royal was renowned mostly for its formal design water garden. John Aislabie worked here since 1716 on the water garden of the park. As a Minister of Finance he had to withdraw to his estate ashamed due to a scandal of corruption in 1721, where he devoted the rest of his life to the enhancement of the park. As a consequence, his son, William, who worked also as a landscape architect, voted consistently against the Walpole government, and tried to recover the honour of his father after his death. The most apparent work of William Aislabie was the Mackershaw Valley north of the formal water gardens, established around 1740 as a picturesque landscape garden. Descriptions already from 1744 make references to a Chinese Garden, also called as the Chinese Forest [42], located at the eastern edge of the park. (Fig. 7a) Two Chinese bridges provided access to the 3.6-hectare area from west. In addition to the garden walkways and terraces, the Chinese Pavilion located on a limestone cliff was also an eye-catcher [40].

The pavilion located on a romantic brow of a hill provided view to the valley, the waterfalls, the Octagon Tower and other features of the park. (Fig. 7b) Nevertheless, the most spectacular view



Fig. 6a–6b. *The Chinese House and the Chinese Pavilion at Wroxton Abbey [Delany, 1754]*



Fig. 7a–7b. *Survey map of Studley Royal, 1856 (National Library of Scotland). The red circles indicate the location of the Chinese House and the Chinese Temple; The location of the Chinese Pavilion on the brow of the hill, and the drawing of the pavilion [Conner, 1978]*

was that of the valleysides composed by cliffs and woodlands. “*These unfrequented woods I better brook than flourishing peopled towns, Here can I sit alone unseen of any, And listen to the nightingale’s complaining notes*” [14].

Writing about his visit to Studley Royal, Philip Yorke, 2nd Earl of Hardwicke, who is also known for his Wrest Park, highlighted the outstanding naturalness of the landscape, the trees covering the cliffs, the lawn and the parterres. According to his diary, Aislable intended to build a pagoda in 1744. Instead, he built a small open pavilion that, in Yorke’s opinion, fell short of the authenticity of the pavilions in Stowe, Shugborough and Wroxton [8].

The pavilion was far away from the castle and the frequented places, which is also the reason why it had been preserved for a long time. However, today only the plinth exists.

Shugborough

The Chinese House in Shugborough was built by Lord Anson adjacent to a canal not far from the mansion. He supported its authenticity with the fact that unlike the Chinese pavilions and houses of those days, this was built on the basis of drawings prepared by Percy Brett, an officer who accompanied him on his Chinese tour. The Lord had a notoriously negative image of the Chinese “under that poverty of genius, which constantly attends all servile imitators”. This statement is rather queer regarding that the first building he established at the estate after his return to home was a Chinese house [26]. Philip Yorke describes the house in 1763 as: “*the most complete Chinese building I ever saw.*” [16] Originally, two bridges provided access to the house, and there was also a boathouse behind (Fig. 8). This was followed by a pagoda in 1752. The 1795 flood destroyed the bridges and the pagoda, and then the surroundings of the Chinese House was also completely changed. Though in its current situation it does not offer any views to the surrounding landscape, as we can see on the picture from the period and the map by Cousins, originally a canal was leading to the mound that raised the building above the level of the garden, thus providing an emphasis to its appearance. (Fig. 9) We can see similar solutions on the etchings of Ripa for pavilions. Boating and summer retreat to the house were probably forms of relaxation [36]. In his book on his travels in England from 1780, Pennant remarks that the Chinese House is a genuine instance of the Chinese architecture owing to the talent of Percy Brett, and “*not a mongrel invention of British carpenters.*” [32]. This way he drew attention to the contradiction of the period, namely that at the end of the 18th century the relationship of the image of China to the Chinese reality was still unclear. In the middle of 20th century, the Chinese



Fig. 8. The Chinese House and two Chinese bridges adjacent to the canal in Shugborough, with the boathouse in the background on the illustration of Moses Griffith, ca. 1780 [Cousins, 2015]



Fig. 9. The Chinese House and Bridge in the Shugborough Park on maps from 1770 (Cousins, 2015) and 1882 [National Library of Scotland]

House is described by Hugh Honour “as delightful a specimen of mongrel chinoiserie as ever appeared in England.” [19] The painting by Nicolas Dall vividly presents the eye-catchers of the spatial composition at the Shugborough Estate, among which the Chinese structures play an important role.

Conclusions

The image of China perceived by the Europeans in the 17th to 18th century was based on the travelogues of the travellers and missionaries. Despite the fact that the first descriptions did not include any pictures of the world, people and landscapes described, the far exotic country with its history and tangible heritage became very popular. Later the richly illustrated travelogues by Nieuhoff then Ripa provided a real insight into the visual world of China. As a result, a general understanding and image of the landscapes, buildings and gardens of China started to evolve by the end of the 17th century. The essay by Temple also shows that the discussion of the topic in Europe was not merely limited to the factual description of China, but became a source of inspiration for rethinking the European perception of the landscape.

At first, the design of Chinese buildings was applied to certain European buildings, as an indication of the function of the building, recalling specific locations described in the travel reports on China. The riverside palace of Augustus II or The

Porcelain Trianon of Louis XIV provide the paragons of Chinese feast and entertainment.

The appearance of the first explicitly Chinese building as an element of staffage in the landscape garden of Stowe reflected the visual world described by the travelogues of the period: a tiny house, pavilion on an island with various ornaments and accompanying elements referring to China. The surroundings made also important part of the scene, reflecting on the corrupt political world of the period. Thus, we can assume that the building was not merely a visual reference to China, but included also moral hints. Since the windows of the house were covered with bunting, the focus was not on the view from, but on the view of the building.

On the contrary, the buildings in Wroxton referred specifically to the closeness to Nature, retreat and contemplation. Their location was significant for both their appearance and the views provided. In addition to relaxation, they also served for representation, providing a unique location for social entertainment.

In the case of Studley Royal we can also observe that before the construction of the Chinese Pavilion an area named Chinese Forest had already existed, and the pavilion was located at the edge of this forest. A political thread was also present here, since John Aislabie, the landlord, was the fallen Minister of Finance in the corrupt government mentioned in relation to the Park of Stowe. Following the landscaping ambitions of his father, but with a different approach, his son converted the outlying valley of the estate into a picturesque landscape garden. The pavilion located on the romantic brow of a hill provided view to several other features of the park, but the primary goal was to focus on the

view of the valley. Similar to Wroxton, the demand to escape from the urban life was also strongly present here.

The purpose of creating the Chinese Pavilion in Shugborough was the provision of an authentic but unique visual feature. The source of the design was an authentic sketch. We can assume that, in addition to the building, the surroundings depicted on the drawing may also had been considered for the design. The location of the building and the accompanying elements such as the bridges and the boathouse is similar to the original depiction. The emphasized authenticity is a reflection to the false visual appearance of earlier Chinese pavilions built in Europe. This fact is also supported by a remark from Pennant in 1780, writing that the house is not a “mongrel” invention of the British carpenters.

The pavilions reviewed are all part of a scene where water makes an essential element of the view composed, as a stream, canal or pond. The presence of water also highlights that the descriptions and depictions in the sources referred provided a framework for the appearance of the Chinese garden features in Europe as follows:

- garden building raised above the water
- garden building on the waterside
- garden building on an island
- garden building with a view located on the brow of a hill

Both the pictures by Nieuhoff depicting riverside towns and locations and the etchings by Ripa of the emperor's residence provided reference for the visual appearance, while the functions of the buildings reflect the contents described in the travelogues on China.

TABLE 1

Overview of Research Results [created by authors]

Name	Year	Spatial composition	Possible image sources	Function
Stowe	1738	pavilion raised above the water	Matteo Ripa's engravings	visual and moral reference to China
Wroxton Abbey	1739	pavilions on riverside and on an island	Matteo Ripa's engravings	closeness to nature, retreat; representation
Studley Royal	1744–	with a view located on the brow of a hill, river in the valley	Nieuhoff illustrations	escape from urban life
Shugborough	1748	pavilion on waterside and on an island	Matteo Ripa's engravings	authentic representation

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Kopsavilkums. Raksts ietver izpētes materiālus par Ķīnas paviljoniem (pagodām, tējnīcām), kas tika uzcelti Eiropas ainavu dārzos pirms 1750. gada. Ķīnas paviljoni tika veidoti bez jebkādiem arhitektūras plāniem, izmantojot tikai skices, kas balstītas uz dažādiem materiāliem un ceļojumu aprakstiem, jo 18. gadsimta pirmajā pusē nebija pieejami atbilstoši tehniskie norādījumi. Ķīnas paviljoni kā acu pievilinātāji ar savu izskatu Eiropas dārzu vēsturē spēlēja kompozicionālu akcentu visos ainavu dārzos, veidojot telpiski piesātinātu, interesantu un mainīgu ainavtelpu.

Geomorphing effect of sand fences in primary dunes of Gulf of Riga

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Abstract. Finding a the most appropriate solution for the problems caused by coastal erosion is very important, as erosion prevention and habitat management measures must promote the restoration of the natural balance (order of things before anthropogenic disturbances) and restore the coastal status quo as much as possible [6; 2].

Dune fences are a very widespread erosion management tool on developed sandy coastal areas due to ease of installation, inexpensiveness, and generally positive public attitude [1]. Effectiveness and impact of fences have also been studied in many places around the world, however previous studies in Latvia have been very limited and episodic [16].

This article shows the observed dune and high beach area evolution of the coast in Riga, a somewhat developed coastal section on the top of the Gulf of Riga, Latvia, over a 4-year period from 2017 to 2020. Dune fences were installed along several short, but significantly disturbed sections of coast in 2018 and 2019. Implementation area is one of the busiest parts of the coast of Latvia dealing with the highest level of anthropogenic disturbance. Data has been derived from cross-shore transects (n=12) along the 17 km long coastal section between Daugava and Gauja river mouths.

The findings generally indicate a very intense initial wind driven sand accumulation in the target areas compared to the background situation. It also seems that such a method may in the longer term be responsible for reduction of the primary dune height and beach width.

Keywords: foredune morphology, dune fencing, anthropogenic influence, coastal processes, coastal landscape

Introduction

Gulf of Riga coastal zone is area of particular economic and social vulnerability to erosion due to its relatively high extent of development and high recreational load [7]. Coastal features in this area have been formed during the last transgression of the Littorina Sea in the convergence zone of long-shore sediment flows and have been significantly augmented by sediments from the three largest rivers of Latvia (Daugava, Gauja and Lielupe). A low and flat coastal landscape has developed, which has historically been dominated by sediment accumulation. Nowadays, high recreational pressure (mainly causing dune vegetation trampling), the reduction of river sediment influx (due to dams and alterations caused by drainage systems) and pressure from climate change related stressors, have all contributed to the development and acceleration of dune erosion. In most cases however, erosion does not pose a significant risk of coastal retreat but lowers the quality of primary dune habitats and makes the landscape less attractive. The first published scientific information concerning coastal processes in Gulf of Riga date from the 1930's and 1940's [22]. One of the most comprehensive looks at coastal origin, morphology, and recent coastal processes was the monograph by V. Ulsts [23].

The best-known feature of sandy coasts is a continually evolving ridge-like primary dune, which is formed over time through mutual feedbacks between aeolian sediment movement and vegetation growth [3; 15]. As dune-building pioneer plant species grow (e.g., *Ammophila arenaria*, *Salsola*

kali and *Leymus arenarius*), they enhance sediment deposition by reducing wind generated shear stress below the critical threshold for sediment transport. On freshly accumulated sand, the dune grasses continue to grow actively creating a self-sufficient feedback loop that promotes further foredune growth [10; 17]. On Gulf of Riga coastal section near capital city Riga, natural dune-building processes are often somewhat modified by several management activities designed to improve beach conditions: removal of beach wrack by mechanized raking, installation of paths and footbridges, as well as installation of temporary buildings and recreational infrastructure. The impact of such measures on the stability and parameters of the coastal dune can be generally negative, creating additional focal points of wind deflation and reducing the potential for natural vegetation to spread [21; 18; 16].

Dune-building fences are commonly used to enhance sand accumulation, and thus to provide increased level of coastal protection, because they are inexpensive (natural materials usually are available nearby) and easily constructed by coastal management providers [12; 11]. Although dune building fences have been used in the coastal dunes of Latvia for several centuries [7], in the study area (prior to 2018 measures), they have not been widely used since the middle of the 20th century.

Since 2018 “dune planting” and “dune fencing” measures were implemented in several sections. Fences were emplaced seaward of the existing natural primary dune, or close to the basis of it to



Fig. 1. Left: A sand catcher fence made of reeds, shortly after installation in the summer of 2018 near Carnikava. Right: The sand catcher fence has greatly increased the accumulation of sand [photographed in the autumn of 2019]

initiate the formation of a new embryonic dune (Fig. 1). Although previous observations in similar circumstances have repeatedly shown an increase in the rate of immediate sand accumulation [16], there is still no certainty that this measure will make a lasting positive contribution to improving the stability of the dune belt.

The aim of the study is to assess and compare the changes in the volume of primary dunes in the target areas versus the background situation, based on coastal slope cross-section monitoring data. The working hypothesis was also put forward that the negative aspects of the fence installation results do not outweigh the positive aspects.

Materials and Methods

Study area. Data was collected from the area located on the top of the Gulf of Riga between the mouths of the Daugava and Gauja rivers, in the central part of the Nature Park "Piejūra". The total length of this coastal section is 18.0 km, but the dune fences included in the study are installed in the total length of approximately 2.6 km (Fig. 2). Coastline of the study area stretches in concave shape mostly in direction from SW to NE and thus is exposed to dominant southwesterly (SW) and westerly (W) winds, as well as rare, but impactful NW storms. The coastal features are relatively recent, formed in Holocene sediments. Study area is represented by some of the most notable foredune ridges in Gulf of Riga reaching more than 5 m in height. Wide beach made of fine-grained sand is present in all of the study area. It has a very important role in the coastal system. During storms, together with the primary dunes, beach acts to ensure the long-term stability of the system, accumulating sediments in calm conditions, and supplying it under extreme conditions to sediment-deficient zones of the coastal slope, simultaneously dissipating and dispersing incoming wave energy [19; 13; 15]. During the hurricane of 2005, study area was subjected to severe conditions due to particularly high surge level. Erosion rate reached

maximum in proximity of the mouth of the Gauja River, where 20-40 m³/m of fine-grained sand was eroded by wave action [9; 8].

Most of the coastal section is almost completely undeveloped, but several sections closer to the capital city Riga and other smaller population centers have experienced moderate development. The whole area is characterized by a very high-quality landscape of low-lying coasts, which is considered to be an important tourist attraction. It can still be argued that in the vast majority of studied coastal area, development can only be attributed to the construction of small-scale recreational infrastructure, therefore, the natural landscape typical of the territory has been preserved. Inland areas in the oldest wooded dunes are also built up in only a small part of the coastal section. Fences are installed in coastal sections close to the developed areas (Fig. 2), except for the part of the coast where the anthropogenic load is the highest in the study area and where the formation of embryonic dunes has not been possible at all for a long time (Fig. 3).

Environmental conditions. According to data from levelling cross-sections established in the area in 1989, periods dominated by erosion and accumulation followed each other several times, however, in general there is a weak prevalence of accumulation in most areas. The predominance of erosion, as an exception to this regularity, occurs where the highest concentration of holidaymakers is observed (Fig. 3). Since 1989, the average accumulation rate of wind-blown sand in the study area has been 1.0-2.5 m³/m per year. Episodes of catastrophic erosion of the coastal slope are very rare. Significant cases of erosion were observed only during the storms of 1993, 1999, 2001 and 2005, when 2-40 m³/m of sand was washed away in each episode [4; 14]. Today, coastal sections with historical (since the mid-20th century) conditions of heavy wind induced erosion, as well as the main concentration areas of holidaymakers, are at higher risk of wave induced erosion, which in turn affects

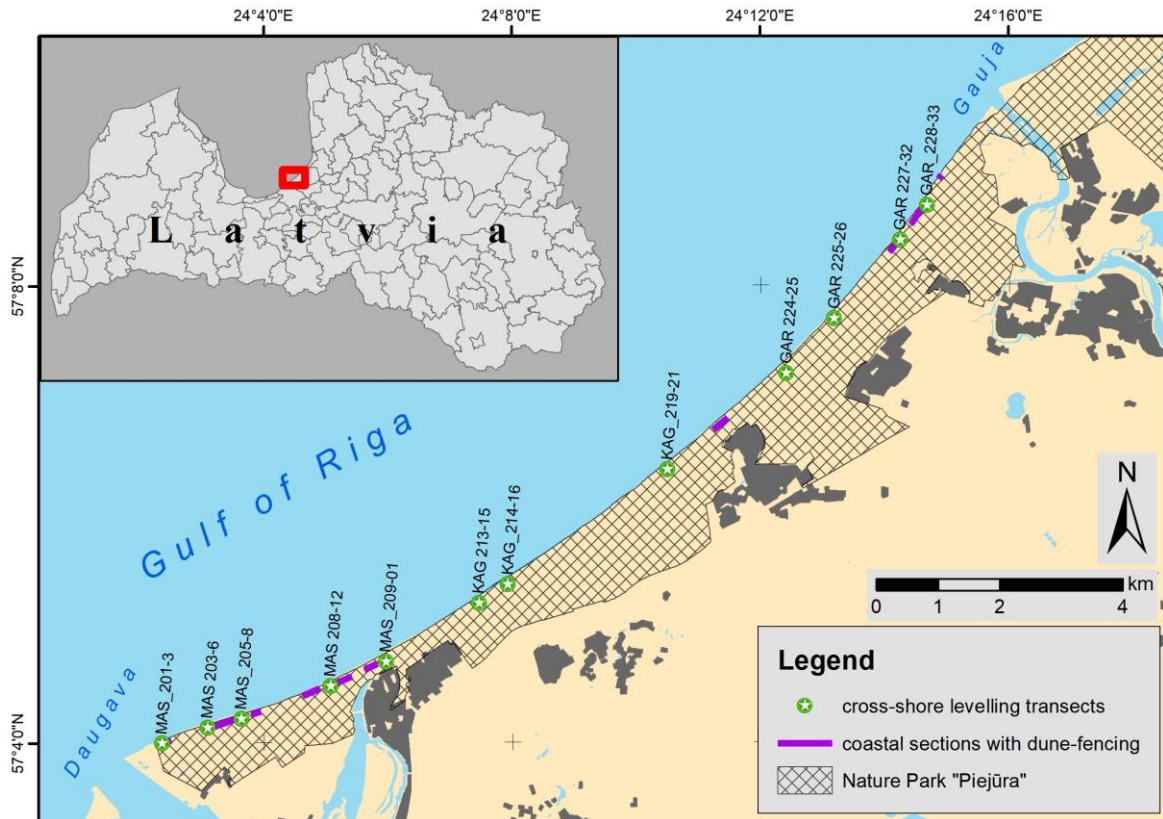


Fig. 2. Study area – coastal section between Daugava and Gauja river mouth's within the Nature Park "Piejūra". Map shows location of cross-shore levelling transects (cross sections) used in this study, as well as location of coastal sections with installed dune-fences [created by author]



Fig. 3. Beach and dune area in the coastal area, where the highest concentration of holidaymakers is usually observed (opposite the center of Vecāķi). Natural dune formation is not possible in this place, as well as fences were not installed here, therefore this section was excluded from the assessment made in the study [photo from author private archive]

the condition of existing primary dune habitats, beach width and beach sand volume.

Data acquisition. Coastal geological processes monitoring network in study area consists of 12 cross-shore leveling stations that are perpendicular to the coastline and are covering subaerial part of the coastal slope (Fig. 4). Leveling profiles are located both in dune fences implementation area and in adjacent coastal sections with no fences (Fig. 2). The measurements have been conducted on the yearly basis in late summer and early autumn. Using local fixed benchmarks of known elevation during leveling data analysis,

adjustments are made, to consider for deviation of sea level from the mean sea level datum. The data are available in the database of the Laboratory of coastal processes at the Faculty of Geography and Earth Sciences of the University of Latvia.

Data analysis. Analysis of changes (dynamics) in the volume of sediment, was undertaken separately for the beach and the active aeolian relief employing a least squares technique. For the purpose of this study, assumption was made, that the upper limit of the beach is the foot of the primary dune. Accordingly, the upper limit of primary dune was taken as the point where vertical changes resulting from aeolian processes do not exceed 0.02 m in one year.

The amount of beach and primary dune forming sediments were processed by using the formula [15]:

$$V = \sum_i \frac{(Q_i + Q_{i+1}) \cdot L_i}{2}, \text{ where (Fig. 5):}$$

- V – volume of sediments in a particular coastal area (m³);
- i = 1, 2, ..., n.;
- Q – area of coastal slope cross-section (m²);
- L – distance between coastal slope cross-sections (m).

The calculated data from each section are arranged in 2-D graph, where X is the year of survey, and Y is the eroded or accreted sediment

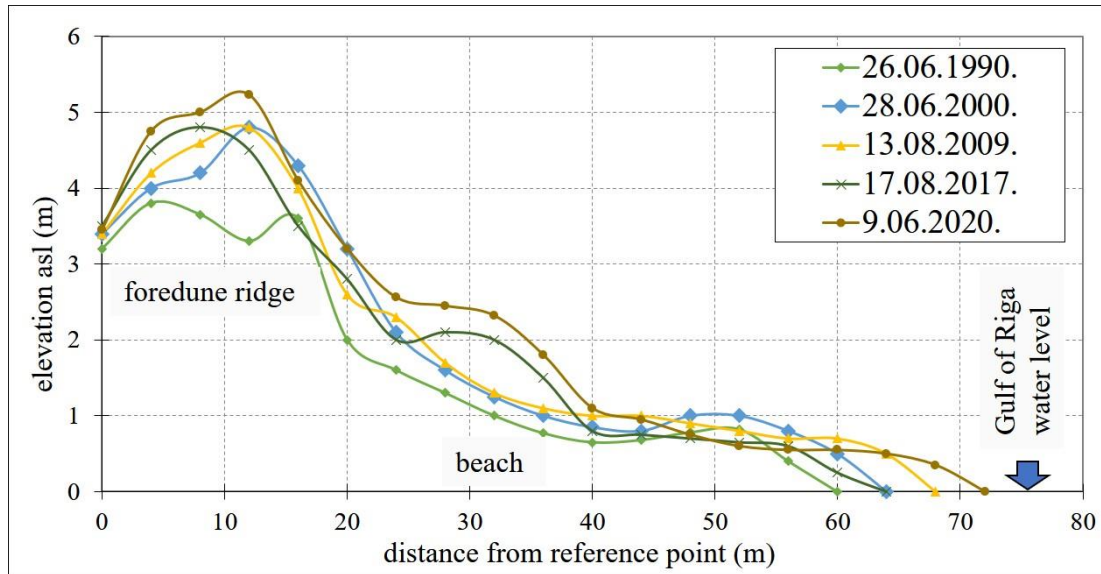


Fig. 4. An example (visualization of one of the cross-section profiles of a coastal slope) that illustrates in a simplified way the changes in surface relief between 1990 and 2020. Data on sediment volume changes obtained from 12 cross-shore levelling transects (cross-sections) were also used to assess the background situation [created by author]

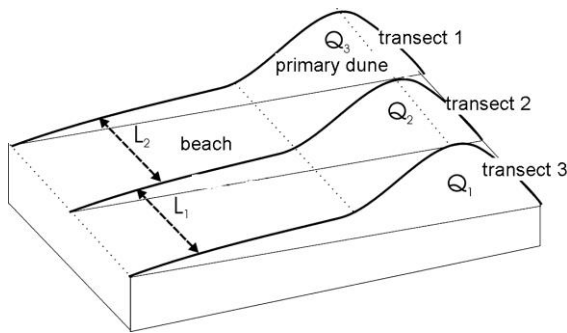


Fig. 5. Parameters used for primary dune deposits volume calculation [created by author]

volume relative to the first year of survey. This permits the determination of annual changes in sediment balance. Coastal changes in sections between measurement sites are interpolated.

After an analysis of the data obtained from the on-site cross-shore leveling stations, a map of the predominant coastal processes of study area was made, maximum coastal changes (sediment balance in primary dunes) were determined in $m^3/m/year$. To test for the statistical significance of differences in dune morphology comparing the pre-fencing and post-fencing change in primary dune volume Kolmogorov-Smirnov test was performed.

Results

The average change in primary dune elevation for the study period is $+0.30$ m, representing an overall growth in natural dune elevation since the beginning of the study period. Non-fenced and fenced areas both experienced increase in elevation, but non-fenced areas experienced an average

elevation change of $+0.38$ m while fenced areas experienced an average change of $+0.25$ m.

Increase in dune widths was significant, with natural dunes in non-fenced and fenced areas broadening over time. The mean natural dune width in increased overall for 3.0 m. Non-fenced dunes widened for 2.1 m while fenced dunes experienced an average widening of 4.9 m. Natural dune building processes involved in the formation of a new embryonic dune are dependent mostly upon the ability of pioneering vegetation to survive seaward of the previous vegetation limit. In contrast, the formation of a dune in the presence of a sand fence requires only sediment input.

It was found that in most of the fenced dune areas the accumulation of sand brought by the wind took place in the amount of approximately $3.0-5.0$ $m^3/m/year$, which significantly exceeded the background level of non-fenced dunes – $1.0-2.5$ $m^3/m/year$. Particularly active accumulation took place in the immediate vicinity of the fences (mainly on the leeward side), as well as in a strip about 5-10 m wide near the fences. Observation was made, that after the implementation of fences the dune which had been growing vertically slowed its growth concurrent with vertical accretion of the non-fenced dune (Fig. 6).

Two summers after the implementation the very significant initial accumulation rate has decreased, but it should be noted that the implemented measures are "self-sufficient", and their functionality will remain for several years even if the fences are not restored.

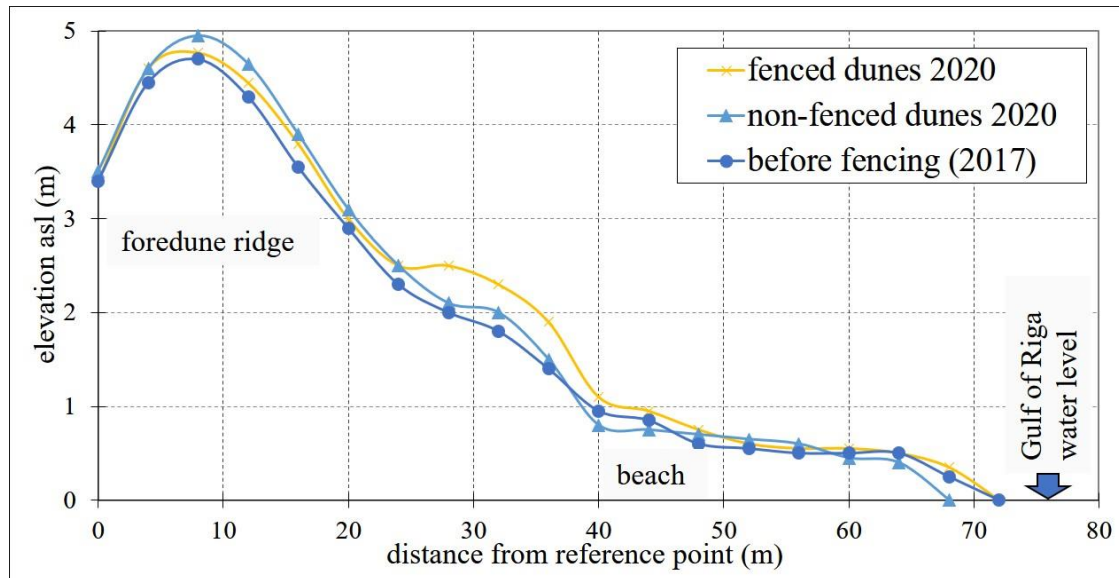


Fig. 6. The resulting agglomerate (composite): foredune and beach cross-section changes since 2017 (line with circles) in coastal sections where “dune fencing” anti-erosion measures were implemented (line with squares) versus the coastal sections where no fences were installed (line with triangles) [created by author]

While much greater spatial resolution of data may be required to analyze differences more clearly between fenced and non-fenced dunes, changes in natural dune elevation and width demonstrate that growth in volume of the fenced dunes came due to growth in width and not in height. Nevertheless, the very significant predominance of accumulation in these dunes suggests that the long-term intensive accumulation will also lead to an acceleration of the height increase of these fenced dunes. Probably at the cost of decreased growth of the natural non-fenced ones.

It is generally believed that a higher primary dune provides more protection against storm induced wave erosion [20], still, the lower but wider dune ridge (as in fenced areas) may be more resistant against wind erosion and against the trampling by the coastal visitors [5]. The second option is considered more desirable in this recreational coastal area.

Conclusions

- The data clearly shows the role of dune fences in initiating rapid sand accumulation. Observed

Acknowledgements

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high efficiency must, however, be viewed within a context of favorable conditions existing during study period – continuous sand supply from the nearshore zone combined with the absence of significant storm events.

- Analysis of the changes in morphology of primary dune crosssections shows that there has been a statistically significant difference in shape and volume of fenced and non-fenced dunes. It should be noted that the difference in dune parameters is somewhat marginal and may be explained by the selection of locations for fence installation and / or locations of measurement cross-sections.
- In order to increase spatial resolution of surveys and deepen the understanding of relationships between recreational load, habitat maintenance measures and dune stability, the use of low-altitude unmanned airship photogrammetry system is necessary. The application of such a method would significantly increase the number of coastal cross-sections analyzed in the study.

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Kopsavilkums. Meklējot risinājumu krasta erozijas radītajām problēmām, ļoti svarīgi ir izvēlēties tādas piekrastes apsaimniekošanas pasākumus, kas veicina dabiskā līdzsvara atjaunošanos, nodrošinot īpaši aizsargājamo biotopu un ainavas kvalitātes saglabāšanu, kā arī rekreācijas iespējas. Vēja nesto smilšu uzkrāšanos veicinoši žogi ir ļoti plaši izplatīti apsaimniekošanas rīks teritorijās, kuras tiek intensīvi izmantotas un sastāv no smiltīm. Šādu žogu ierīkošana ir relatīvi vienkārša un lēta. Piekrastes apmeklētāju attieksme pret tiem kopumā ir pozitīva. Žogu efektivitāte un ietekme ir pētīta daudzviet pasaulē, tomēr iepriekšējie pētījumi Latvijā ir bijuši ļoti ierobežoti un epizodiski. Rakstā tiek apskatīta primāro kāpu un augstās pludmales attīstība Rīgā, Dabas Parka “Piejūra” teritorijā, Rīgas jūras līča virsotnē. Pētījums aptver četru gadu periodu no 2017. līdz 2020. gadam. Kāpu žogi 2018. un 2019. gadā tika uzstādīti vairākos īsos, bet samērā aktīvi apmeklētos piekrastes posmos. Pētījuma teritorija ietver vienu no rekreācijas ziņā noslogotākajām Latvijas piekrastes daļām. Dati iegūti, veicot tehnisko nivelēšanu krasta šķērsprofilos (n=12), kas izvietoti 17 km garā piekrastes posmā starp Daugavas un Gaujas grīvām. Rezultāti liecina par ļoti intensīvu smilšu uzkrāšanos pastiprināšanos tajos krasta posmos, kur uzstādīti žogi. Konstatēts arī, ka šāda piekrastes apsaimniekošanas pasākuma masveidīga izmantošana, ilgtermiņā var izraisīt primāro kāpu maksimālā augstuma un pludmales platuma samazināšanos.

Atslēgas vārdi: priekškāpu morfoloģija, “smilšu ķērāji”, antropogēna ietekme, krasta procesi, piekrastes ainava.

Continuity of traditions and innovation in modern landscape design in China

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Abstract. The article analyzes the features of traditional Chinese landscape design and its impact on the landscape design of modern Chinese parks. The purpose of the article is to compare the historical gardens and modern parks of China in order to determine the continuity and at the same time the features of innovation. The main difference between historical gardens and modern parks is emphasized: historical gardens were aimed at creating a calm, serene atmosphere of contemplation of nature; modern parks often combine traditional landscape techniques and the function of entertainment. The main historical landscape techniques provided for the presence of a lake and artificial mountains as symbols of immortality, a constant change of views, contemplation of the landscape through the opening as a picture in a frame, the inclusion of a small garden in the large, partitioning the space with "green screens". Modern parks in China still inherit these techniques in general: they have reservoirs, a lot of greenery, park pavilions, but there are already views from distant points, the parks are surrounded by a wall of skyscrapers, entertaining attractions have appeared in them, and in the evenings they are illuminated with bright illumination. Despite their attractiveness and modernity, the atmosphere of the Chinese garden has changed from a secluded personal to a public character, as can be seen in the examples of modern parks in Xi'an and Hong Kong.

Keywords: landscape design, China, historical gardens, modern parks, continuity

Introduction

A feature of traditional Chinese architecture is its conservatism: despite the change of ruling dynasties, architectural continuity has been preserved at all times, including in landscape design and architecture of small forms. Despite the apparent dependence of the original silhouettes and pictorial landscape paintings on the architect's intention and their conditioning exclusively by aesthetic considerations, all elements and principles of garden planning and placement of an object in the natural environment had a clear hierarchy, semantic meaning was often hidden, and obeyed the principles of Feng Shui, Taoism, Confucianism and Buddhism, and social hierarchy. In the minds of the Chinese, architecture was a specific way of harmonizing the surrounding space and at the same time was a constituent part of the Universe, and it was required to achieve a harmonious combination of architecture as an artificial environment and the natural environment. Thus, architecture was endowed not only with its own aesthetic qualities, but with a certain mystical and sacred content.

Since ancient times, the Universe has been understood as a balanced combination of the elements of heaven, earth and water, and the beginnings of these beliefs go back to the Bronze Age. Thus, having arisen in close connection with cosmogonic beliefs, culture, and subsequently architecture and art of China, preserved these beliefs, developed them and materialized them by artistic and architectural means, including in

traditional landscape design. Traditions of the cult of the immortals originate from ancient times, the symbolic meaning of the simplest geometric figures as symbols of immortality, the special meaning of water, which was subsequently expressed in the abundance of reservoirs – natural and artificial – in gardens. Over the centuries, the architecture and landscape design of China has improved while maintaining the overall harmonious balance of "nature-building-human". Small architectural forms – pavilions at springs, water pavilions, the so-called pavilions for admiring the landscape and garden pavilions – became directly specific. So, pavilions for admiring the landscape have always stood in a picturesque natural environment and a beautiful view of the surroundings opened from them, often they were graceful open pavilions without external walls, standing on top of a mountain or over a waterfall. Among landscape pavilions, the type of mountain pavilion was especially widespread as the most aesthetically perfect; in the Qingcheng Mountains in Xihuan province, about twenty such pavilions have survived. An example of such a view pavilion should be called the pavilion of Holding the Sun in Mount Jiu hua, designed for viewing the sunrise (which led to its poetic name). The rising of the Sun thus becomes one of the most widespread view pictures – "tian tai xiao ri". Such mountain pavilions had poetic names, always due to either the surrounding landscape, or the seasons, or the emotions generated by the landscape (The Second



Fig. 1. View on the Cloud Capped Pavilion in the Liu Yuan Garden, Suzhou [watercolour by P. Chang]



Fig. 2. View on the Fan Pavilion in the Shi Zhi Lin Yuan Garden, Suzhou [watercolour by P. Chang]

Spring under Heaven Pavilion at Mount Huishan, Thatched Pavilion in Mount Qingcheng Heart-Cleaning Pavilion in Mount Emei).

Water pavilions could stand on wooden supports fixed in the bottom of the reservoir, as if "growing" out of the lake. The thickets of lotuses made such pavilions especially picturesque. The specific picturesqueness of the pavilions above the springs was explained by the fact that these pavilions were illuminated by the sun's rays from the inside, through a hole in the roof, which signified a change in the negative energy of underground water (yin) to positive energy (yang).

Finally, the creation of landscape views in private gardens has reached particular perfection, the standard of which for centuries has been the private gardens of Suzhou.

In order to study the features of traditional Chinese landscape design and the continuity of historical traditions in modern gardening art in China, the authors studied an extensive scientific base devoted to traditional Chinese landscape design and architecture of small forms. The analyzed publications were grouped according to the aspects considered. Thus, publications by Li Chunqing [9], Wang Yi [19], Pan Jiaping [13], Tong Yu Zhe [16], Liu Na Zhu Guang Yu [24], Jiang Zhenpeng [8], Xing Yue, Fang Liqiang [1], Huang Wei [4], Pei Yuansheng [14], Wang Guanglong and Zhang Hangling [18], Guan Xihan, Gong Lingjuan [3], Zhou Weiquzen [23], Liu Donghen [10], Zhao Guanghua and Qiu Mao [22], Zhu Junzhen [25], Lou Qingxi [11], Fang Zhirong [2], Huang Mingshan [4], Qin Li [15] are devoted to the peculiarities of traditional Chinese landscape design and the role of Feng Shui.

The defining features of traditional Chinese architecture and the features of gardening art are analyzed in the studies of Zhu Guang Yu [24], Liu Dunzhen [10], Lou Qingxi [11].

The publications of European and Ukrainian researchers of Chinese architecture and landscape design N. Vinogradova [17], M. Dyomin, M. Orlenko, A. Dmytrenko, Y. Ivashko, T. Kuzmenko, P. Chang, D. Chernyshev, D. Kuśnierz-Krupa, Y. Kobylarchik, M. Krupa [5, 6, 7, 12] were analyzed.

The purpose of the article is to compare the historical gardens and modern parks of China in order to determine the continuity and at the same time the features of innovation, to identify ways to revive national landscape traditions according to the government line.

Materials and Methods

The study used traditional scientific methods of historical analysis (to study the traditional landscape design of China at different periods), comparative analysis (to compare landscape techniques in historical and modern gardens and parks), as well as

a graph-analytical method (for research, analysis and comparison of plans of gardens and parks and views). The methodological base was supplemented by the authors' photographs. The combination of the theoretical basis of the study based on the analysis of sources and field surveys of gardens carried out by the authors made it possible to formulate characteristic techniques that are used in modern Chinese landscape design and analyze the degree of their continuity with centuries-old landscape traditions.

The canons of traditional Chinese landscape design

The basis for understanding the canonical principles of traditional Chinese landscape design, enshrined in a number of scientific and practical treatises, is that the Chinese garden was never understood as a reflection of a real natural environment, but was a kind of simultaneous synthesis of several of the most recognizable natural scenes, which were given a perfect character. You need to understand that, for example, landscape scenes in the most famous gardens of Suzhou were not a literal repetition of some natural motives, but generated analogies with them and created an image of some kind of "ideal environment" without flaws that can be present in wild nature as crooked unaesthetic tree, felling, burnt branches, broken off tops, etc. Moreover, in natural nature there is no such endless change of such different views and not all such views are equally perfect: for example, in nature, a pine forest cannot alternate with a well-groomed flower garden or necessarily surround a lake or waterfall. Consequently, the artificial garden symbolized such a change of picturesque paintings, completely different, not only the continuity of changes in nature and in the Universe, but created the image of a perfect world in which all natural landscapes are perfect, which was most vividly and concentratedly manifested in the gardens of Suzhou, many of which were included in 1997 and 2000 in the UNESCO World Heritage List.

Most likely, the landscape design of China would not be so expressive without architecture of small forms, which play a secondary role in relation to the natural environment, but successfully accentuate the beauty of this environment. Small architectural form - the pavilion has gone through centuries of development from a purely strategic purpose during the Zhou Dynasty to the first view pavilions during the Southern and Northern Dynasties, the first garden pavilions of the Tang Dynasty and the crown jewel of landscape design, first in the Ming era, and then Qing. Among the most famous view pavilions are:

1) mountain and hill pavilions: Seven-Star Pavilion Group in Zhaoging, The Second Spring under Heaven Pavilion at Mount Huishan, Thatched Pavilion in Mount Qingcheng, Two-Immortal Pavilion, Tiger Hill, Heart-Cleaning Pavilion in

Mount Emei, Shuangfei Pavilion in Mount Emei, Sichuan Province, Shuixin Pavilion of Jixiao Mountain Villa in Yangzhou, Jiangsu Province, Rafting Rock Pavilion Group in Mount Shizhong, Hukou, Jianxi Province;

2) water pavilions: Mid-Lake Pavilion of West Garden in Suzhou, World View Pavilion in West Lake, Hanzhou, Kaiwang Pavilion at Hangzhou West Lake, Zhejiang Province, Small Yingzhou in West Lake, Hanzhou, Zhejiang Province, The Water-Division Pavilion at Huoquan Spring in Hongdong County, Shanxi Province, Mid-Water Pavilion in Chengde Mountain Resort, Hebei Province.

Consequently, the main task of the view pavilion – mountain, water, garden – consisted not so much in clearly prescribed functionality, as it was in the early pavilions (military, post, roadside), but in creating a certain mood of peace and quiet using landscape design methods or the successful insertion of artificial facility in an unspoiled scenic natural environment.

The principles of creating a harmonious natural space were embodied in both private and imperial gardens: for example, two artificial lakes were arranged in the imperial garden in Beijing in 1267, the same artificial lake and mountains were built in the Iheyuan imperial park in the 18th century, and here one can see direct allusions with the Buddhist painting genre "shang-shui" ("mountains-waters").

If we identify the differences between private and imperial gardens, then these differences consisted not in the techniques and the list of obligatory species pictures with a certain hidden meaning (like the landscape "one lake-three mountains", symbolizing the cult of the Immortals), but above all on the scale of the garden and views – grand-scale in the imperial gardens and finely detailed in private ones (Fig. 1, 2). It is noteworthy that over time, the art of private gardens reached such a high level, which in turn influenced the views in the imperial gardens.

Traditionally, Chinese landscape design interpreted the garden as a link between the harmony of nature and man, and in this dialogue man was assigned a secondary contemplative role, which corresponded to the philosophy of Taoism, Confucianism and Buddhism and the principles of Feng Shui. That is why the views of the garden had a complex semantic interpretation – either they were reservoirs with artificial stone slides as symbols of achieving immortality, or spaces covered with green "screens" with the impossibility of simultaneously viewing the entire garden to prevent the movement of evil demons descending from the sky. Large stones, such as the sacred stones from the bottom of Lake Taihu, which gave rise to allusions with calligraphy due to their original forms, due to the skillful work of stonemasons, also had a definitely symbolic meaning. The unity of the Chinese landscape environment with

shang shui ink painting, calligraphy, and traditional poetry is explained by the fact that famous artists and poets sometimes showed themselves creatively in landscape design.

The period of the greatest flourishing of traditional Chinese gardening art should be called the Ming and Qing eras, when there is a flourishing of garden and landscape pavilions and landscape design in general. Based on the publications of N. Vinogradova [17], we can mention two main directions of Chinese gardens of the 17th – 18th centuries – the southern, represented by the private gardens of Suzhou, a distinctive feature of which was the detailing of natural paintings and the picturesque space of relatively small areas, and the northern, represented by the imperial gardens of residences near Beijing. In addition to private and imperial gardens, gardens at temples and monasteries flourished, such as the Tanchzhe and Zetai gardens in Beijing, the Jin Temple garden in Taiyuan in Shanxi province, the Linyinxi Temple garden near Lake Xihu in Hangzhou in the Zhejiang province. The main difference between temple gardens and private ones was in their maximum naturalness, while the basis of private gardens was to emphasize the ideality of the landscape without the need for full natural correspondence; landscapes of different regions of China, embodied in miniature, could coexist side by side.

Traditional Chinese landscape techniques were reduced to the creation of perfect views, smoothly flowing into each other with the subordination of architecture to the environment, blocking spaces with green "screens" and pavilions for the absence of distant perspectives, fusion of the picturesque stylistics of landscape and architecture, the embodiment in miniature of recognizable landscapes of China, including a special place was occupied by the theme of water and mountains, the perception of a landscape painting as an image in a frame, including through the windows of the pavilions, a clear thought through the view paintings opening from the pavilions and a certain orientation of all buildings according to Feng Shui.

Traditions and innovations in modern landscape design in China

Today, the Chinese government has proclaimed a line on the ecological education of the population and the greening of the environment. One of the aspects of this policy was the increased interest in the historical gardens of China, their development as centers of world tourism, the inclusion of the most famous gardens in the UNESCO World Heritage List. One of the directions was the organization of new parks and botanical gardens in large cities, including in the territories of former industrial enterprises. An example of such a themed botanical garden is the Nanning Botanical Garden in Guangxi Province.

Certain features are associated with the greening of megacities. In order to more accurately assess the influence of traditions on modern landscape design in

China, two large cities were selected for comparison – on the one hand, the city of Xi'an (Cháng'ān) Shaanxi province with ancient history and a large number of architectural monuments, which is the focus of national traditions, on the other hand, Hong Kong, which began to develop intensively from the middle of the 19th century and was a colony of the United Kingdom for more than 130 years, where foreign influence on architecture (including landscape) was very noticeable.

Xi'an city is located in the centre of eastern China, on a tributary of the Yellow River – the Wei River.

The city is a unique centre of monuments of architecture, history and culture of China, including world significance. Its particular importance is due to the fact that Xi'an was the capital of 13 states in the history of China – in particular, during the reign of the Zhou, Qin, Han, Sui and Tang dynasties.

A notable feature of the ancient monuments is that many of them are surrounded by gardens or are in close proximity to them (Fig. 3). Such gardens are located near two of the most famous Xi'an monuments – the Big Wild Goose Pagoda (Da Yan Ta) and the Small Wild Goose Pagoda (Xiao Yan Ta), built during the period when the city was the capital of the Tang Empire.

The Big Pagoda, built of bricks, was erected in 652 under the direct influence of the Indian traditions of Buddhist architecture, and in 704 it was built on additional tiers. Currently, there are fewer tiers, only seven, with a total height of 64 meters. From the upper points, vistas open up, and around the pagoda there is a Buddhist monastery with a large park, in which monuments to poets, philosophers, artists and scientists are installed.

The purpose of the Small Pagoda was specific – the storage of Indian Buddhist manuscripts. This archive pagoda was built in 707–709 and is now 45 meters high. The small pagoda is also surrounded by a large park with Buddhist temples and a fountain.

The Huaqing Hot Spring Park with picturesque temples and small architectural forms is also a historical garden and park complex. Both monuments of architecture are high-rise dominants, which can be seen from anywhere in the surrounding parks.

There are several dozen parks in Xi'an, including both created on the basis of traditional Chinese gardens (in the historical part of the city), and modern ones, among which such as Yatong Mengguo Amusement Park, Tang Paradise, Xi'an Qujiangchi Site Park, Xi'an Botanical Garden, Qingfeng Park, Revolution Park, Chuanxiao park, Tang Chang'an Wall Site park should be mentioned. Most of these parks are surrounded by modern high-rise buildings around the perimeter, which can be seen from any point (in this they resemble Central Park in New York)

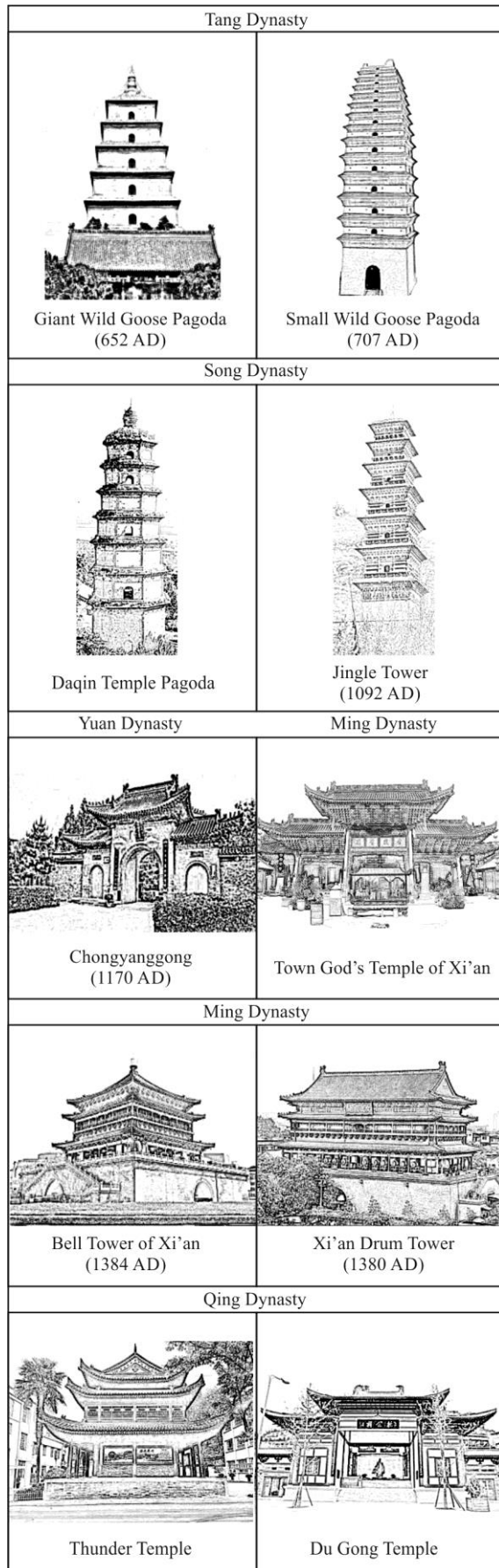


Fig. 3. The most famous Xi'an monuments in the surrounding area [graphics by Y. Ding]

and which contrasts with small architectural forms in the national style.

Elements of national traditions in landscape design (an abundance of reservoirs with national-style pavilions oriented to them in the Xi'an Qujiangchi Site Park, a reservoir with a stone in its center and pavilions with characteristic curved tiered roofs in Revolution Park, rich flower beds with sculptures in the national spirit in Xi'an Botanical Garden) coexist with elements characteristic of Disneyland – for example, sculptures depicting characters from European cartoons.

Continuity with national traditions of landscape design in modern parks of the city of Xi'an, in addition to the significant role of reservoirs (mainly artificial), is also manifested in the use of curved paths, artificial islands, small forms (pavilions, gazebos), executed in national traditions, creating picturesque scenic perspectives. At the same time, in essence, these parks are places of mass visits and in this sense they are the complete opposite of the imperial, private and monastery gardens closed to outsiders, designed for solitude and contemplation of the beauty of nature.

Therefore, they are characterized by the typical features of modern European parks, such as a great homogeneity and naturalness of landscape views, the possibility of viewing parks from distant points (which was impossible in historical gardens), active use in the evening of artificial illumination of both natural elements and small forms (among of which sculptures of an absolutely Western character are common: Dutch girls in national clothes near Dutch-style windmills, Mickey Mouse, etc.), and, finally, the active introduction of the entertainment function.

Hong Kong is a typical example of modern landscaping in a large metropolis.

Using the example of Hong Kong, a metropolis with superdense buildings, one can trace the modification of historical traditions in the modern landscape design of public parks, the area of which ranges from 1 to 20 hectares. For the analysis, several of the most famous parks were taken – Chater Garden mini-park, Hong Kong Central Park, The Hong Kong Zoological and Botanical Gardens. The authors set themselves the task of identifying the landscape design techniques in these modern gardens (parks) and comparing them with those in the historical gardens of China in order to identify continuity and innovation.

The first aspect of comparison is location in the environment. On the example of the Suzhou historical gardens, it can be seen that they were surrounded on all sides by walls to fence off the rest of the city space and create their own isolated microcosm, while the conceived vistas either to the lakes or to a distant pagoda opened up from the garden territory, such a technique was called "borrowing landscape".

Chater Garden mini-park, created in 1978, is located in the business district of Hong Kong near



Fig. 4. Chater Garden, Hong Kong [photo by P. Zueva]



Fig. 5. Hong Kong Central Park, artificial lake
[photo by P. Zueva]

the city hall and high-rise office and government buildings and, despite the picturesque layout, does not create the feeling of an isolated microcosm, since skyscrapers have risen from all sides like a wall (Fig. 4). In a small park such as Chater Garden with an area of 1 hectare, such a "enclosure" of a green oasis with a wall of skyscrapers is felt especially strongly, as well as in an average park of 5.6 hectares, which is one of the oldest parks in Hong Kong, The Hong Kong Zoological and Botanical Gardens, in a larger park like Hong Kong Central Park with an area of 8 hectares, this dominance of human-made high-rise architecture over nature is not felt so clearly.

The second aspect of the comparison is the ratio of architecture and nature in scale. In historical gardens and in landscape paintings, the pavilion is

always secondary and subordinate to nature, in the modern Chater Garden park there is no feeling of the secondary nature of human-made architecture in relation to the natural environment, and the natural environment itself also does not seem natural, without human intervention – this is also felt in the arrangement of trees, and in water bodies. If we talk about continuity, then it is expressed in the concentration on a small area of various trees and plants (in Chater Garden there are 25 species of trees and plants, including tea tree, breadfruit, ginkgo biloba, mulberry tree, etc.).

Another famous Hong Kong park, Hong Kong Central Park, has a more "natural" character (Fig. 5). This was largely due to the peculiarity of the task set for the designers of the international architectural planning and design firm Wong Tung & Partners – the preservation of local diverse plants and trees and the preservation and use of existing buildings of the mid-19th and early 20th centuries for a new purpose.

The third aspect of the comparison is the number of buildings in the garden and their function. In the traditional garden, these were small architectural forms – pavilions, tea houses and gazebos. Hong Kong Central Park has several gates, gazebos, pavilions, a restaurant, cafes, galleries (Forsgate), Vantage Point tower, a stylized Greek colonnade and amphitheater in Olympic Square, a greenhouse and two historic buildings with new features, i.e. many more buildings than in the historic garden, and with the functions of public visits – catering and tourism facilities.

The fourth aspect of the comparison is the silhouettes and geometry of the lines. According to Feng Shui, the layout of the historic Chinese garden was always curved, without straight alleys and the possibility of viewing from a long distance. In contrast, Chater Garden has right angles in the outlines of ponds and glass bridges, which gives the park an urban character. More similarity to a traditional Chinese garden is present in Hong Kong Central Park, which is felt by the smooth outlines of the reservoir (Fig. 5). There are winding paths and garden paths near streams, an artificial lake, waterfalls and fountains. A combination of straight and curved paths is also present in the layout of Hong Kong Zoological and Botanical Gardens (Fig. 6) on the northern slope of Victoria Peak, with entrances from both nearby streets and from Hong Kong Central Park, which was mentioned above.

The fifth aspect of comparison is the elements in the park and their materials. Traditionally, such elements were stone steles with inscriptions, decorative lanterns, stones with original outlines. In the Chater Garden park, such elements are benches under umbrellas, fountains, including multi-level fountains-waterfalls, marble sculpture.

Consequently, in the historical gardens, the maximum "naturalness" of small forms was



Fig. 6. Zoological and Botanical Gardens of Hong Kong. A stand with a plan of the territory for visitors at the entrance to the park [photo by P. Zueva]



Fig. 7. Waterfall in the Hong Kong Zoological and Botanical Gardens [photo by P. Zueva]

emphasized, in the Chater Garden park, for all its picturesqueness, its hand-made and the use of modern architectural techniques and materials were emphasized. Stones, as a traditional element of the garden, are much more used in the landscape design of Hong Kong Central Park, where there are large individual stones and groups of stones.

The sixth aspect of the comparison is the change of landscape views, the standard of which has become the gardens of Suzhou. An example of such a change in landscape views is Hong Kong Central

Park with a variety of ornamental plants and shrubs, conifers and deciduous plants and flowers in the ground, or in pots and grouped by flowering time, with bright flowering.

The seventh aspect of the comparison is the role of water in the garden and in the park. As you know, in a traditional Chinese garden, water bodies occupied most of the park; in modern parks/gardens in Hong Kong, water bodies, although very important, do not give the impression of the main element of the park. At the same time, Hong Kong Central Park uses a much wider range of water bodies than was the case in a traditional Chinese garden. Waterfalls are also found in the Hong Kong Zoological and Botanical Gardens (Fig. 7).

The eighth aspect of comparison is the predicted atmosphere. A historical garden of China was originally conceived as a chamber, not designed for visiting many people, it was a kind of retreat from the hectic world and dialogue with nature in silence. Modern parks in Hong Kong are public parks, in the centres of metropolitan areas, so they were not originally designed for silence, solitude and communication with nature in silent contemplation. In the old gardens of Suzhou, for example, there was no entertainment other than quietly practicing the arts in the pavilions, drinking tea, admiring the scenery, and watching the fish.

For example, Hong Kong Central Park has waterfalls, streams, a garden and a lake, a botanical garden, an aviary with plants and shrubs, a large area for children's games (there were none in the old gardens), as well as museums. We can say that the modern garden of Hong Kong is at the same time an entertainment and educational garden, since children can play here, you can visit museums, from the pedestrian hanging bridges on the section of the aviary located above the ground between the trunks almost at the level of the tree crowns, they allow better consider representatives of flora and fauna.

In the Hong Kong Zoological and Botanical Gardens, opened in 1871 during its existence, with the expansion of the territory, buildings and a list of functions diversified, which was largely due to the merger of the Botanical and Zoological Gardens in 1975 into a single park-complex, divided into an old part in the eastern part (Fig. 8) of the complex with spaces for birds (Fig. 9), greenhouses, a children's play complex, and a new part in the western part with an exposition of mammals and reptiles, a music pavilion building, a Memorial Arch dedicated to the fallen Chinese, who fought on the side of the Allies during the two world wars and a bronze sculpture of King George VI.

In the old part there is a collection of shrubs, over a thousand species of herbaceous plants, most of which are representatives of tropical and subtropical flora. The greenhouse features orchids, roses, ferns, vines, vines, heat-loving plants.



Fig. 8. Zoological and Botanical Gardens of Hong Kong. The Old Garden. Terrace with a multi-tiered fountain [photo by P. Zueva]



Fig. 9. Zoological and Botanical Gardens of Hong Kong. Aviary in the Old Garden. Red ibises [photo by P. Zueva]

The Hong Kong Zoological and Botanical Gardens has themed gardens: Bamboo, Palm, Orchid – Bauhinia, Camellia, Magnolia, Azalea and a variety of herbal plants.

This is not only a garden for contemplating nature, but also an educational garden, as exhibitions are held here, including those on landscape design, gardening seminars, and international research programs have been developed.

Conclusion

A comparative analysis of historical and modern landscape techniques in China testifies to the preservation of iconic traditions – as before, a natural or artificial reservoir or fountain remains the main element of a Chinese park or garden, small green islands connected by bridges, small architectural forms in national traditions are common.

At the same time, modern parks cannot be considered direct analogs of historical gardens, which were closed, chamber, not designed for viewing from distant points. In historical gardens, landscape views were constantly changing and alternating, in modern parks there is no such constant change of different landscape views, often landscaping is quite the same type.

The tradition of distant panoramas and observation of parks from distant points is also different from the historical one. Undoubtedly, the perception of the park in the structure of the metropolis was influenced by high-rise buildings,

which, in fact, perform the same role that high fences around private gardens previously played.

The perception itself of the garden in the urban environment has also changed: in the past centuries, the garden was comparable to the development of the city; in modern conditions, parks are surrounded skyscrapers on all sides. In addition, since the purpose of the garden has changed and there is an entertainment component in it, elements of the entertainment industry and sculptures of European fairy-tale characters have appeared in public parks.

Thus, speaking about the continuity and innovation of modern gardens in China, the following can be noted:

1) continuity – the inclusion of reservoirs, natural stones, winding paths, pavilions in the Chinese style, the use of the technique of changing landscape paintings and grouping plants by flowering time;

2) innovation – changing the purpose of the garden from private to public, with the expansion of the number of functions designed for multiple visitors, entertainment, educational, catering functions appear, the transformation of the garden into an open public space, the loss of a sense of privacy in the microcosm, the use of European landscape techniques (regular planning, fountains, lakes with boat stations), turning the pavilions into a tourist attraction by means of bright advertisements and night illumination.

It is appropriate here to draw a parallel between the Chinese landscape pavilions and the chinoiserie style pavilions, since the chinoiserie style also repeated a limited number of landscape techniques and architectural forms without their initial sacred meaning. Something similar is observed today in modern parks in China, which reproduce some recognizable historical landscape techniques, but with all this, the influence of European landscape techniques is noticeable in them, and national techniques are reproduced without the sacred meaning that they were originally endowed with.

The practical significance of the study is that it outlines the directions in which the development of Chinese landscape traditions, where preserved hereditary features such as the inclusion of water bodies, compositions of natural stones, changing landscape paintings, etc., but at the same time modern parks have public, and not private in nature, and this is their main difference from historic gardens. That is why modern Chinese parks can not have the layout and features of an exclusively historic private garden: the public purpose of parks does not provide solitude in nature, small garden size, intimacy, public parks have additional functions designed for the mass audience – food, entertainment, trade. Similarly, small architectural forms are not copies of historic garden pavilions, as they are also designed for mass attendance and are a tourist attraction.

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Kopsavilkums. Rakstā analizētas tradicionālās ķīniešu ainavu dizaina iezīmes un tā ietekme uz mūsdienu ķīniešu parku ainavu dizainu. Raksta mērķis ietver salīdzināšanu starp Ķīnas vēsturiskajiem dārziem un mūsdienu parkiem, lai noteiktu inovāciju nepārtrauktību un vienlaikus dominējošās iezīmes.

Pētījumā aprakstīti galvenie vēsturiskie ainavu paņēmieni par ezera un mākslīgo kalnu klātbūtni kā nemirstības simboliem. Mūsdienu parki Ķīnā joprojām pārmanto vēsturiskos paņēmienus: tiem ir rezervuāri, daudz apstādījumu, paviljoni. Savukārt, mūsdienās, ja paveras skats no tāliem skatu punktiem, konstatēts, ka parkus ieskauj debesskrāpju siena. Parkos parādījušās daudz izklaidējošas atrakcijas, vakara stundās tiek izmantots spilgts apgaismojums dažādās zonās. Neskatoties uz parku pievilcīgumu un mūsdienīgumu, ķīniešu dārza atmosfēra ir mainījusies no slēgta, personīga uz publisku raksturu, kā to var konstatēt mūsdienu parku piemēros Siaņā (*Xi'an*) un Honkongā (*Hong Kong*).

A study of developing a spatial entity greenway in the case of Irbid City - Jordan

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Abstract. Greenways are urban elements that are designed to show the linear consistency and connectivity between open green spaces and cause a development in the urban texture. As a city starts to grow, the absolute metropolitan development should be followed by an ongoing protection of the rural and urban territories. The nexus between the city development and the fortification of the open agricultural and rural lands is deemed a good strategy in order to result in a homogenous urban fabric of the city. The study aims to present a greenway model of development to work as a prototype applied on an existing route in Irbid City-Jordan by using the methods of testing and analyzing the route during the site visit and by using GIS base maps in order to come up with an absolute combination between monitoring the city growth, maintaining the quality of the agricultural lands and serving the public and local needs in order to result in a more balanced and controlled growth of the city. Irbid city is located in the northern part of Jordan with a radial urban expansion model of growth extending from the historical center and spreading toward the outskirts of the city. Regarding the significant increase in the number of population in Irbid City-Jordan since the 1970s until nowadays and the continuous need for habitats, there was a huge number of housing projects in the inner part of the city that expanded toward the outer part including the rural areas, resulting in a huge lack of agricultural lands and open recreational spaces where people can benefit from. Those spaces form an outlet of the city connected with the inner part by a route. Establishing a greenway along the route raises the integration between people and their lands and encourages farmers to develop and harvest. According to this study, the greenway development, which forms a breath out to the highly built-up area in the city, has become a great tool to result in tremendous beneficial outcomes to the city development.

Keywords: greenway development, urban planning, land revitalization, Irbid city development

Introduction

City development and urban expansion processes are complex, and not quite predictable in all aspects. Thus, in a way, some actions are aimed at rectifying faults and enhancing future growth. Greenways form as systems or networks in which they are designed to manage some parts of the city planning such as; nature protection, biodiversity management, water resources and ecological aspects [1]. Also to support the importance of the cultural recreational and historical protection of the city.

Greenways are urban solutions to form the connection between any kind of open spaces that are open to the public either for recreational use or for other functions such as the protection of the natural resources with the respect of urban safety. As a part of urban green spaces, greenways can also be described as an open space corridor of linear parks that provides natural ecological functions while at the same time offers aesthetical quality and recreational activities for people or can be designed for commuting purposes [12].

John F. Ahern in his article "Greenways as Strategic Landscape Planning" discussed the importance of emerging the greenway as a huge part of the city planning by defining the greenway as a combination between a network of linear corridors,

open spaces and the protected lands connected with these corridors either functionally or physically [1].

*Green spaces and linear parks,
the greenway continuity*

Linear lands are considered as very critical parts of the urban infrastructure to deal with. After the industrial era, lots of cities were left with this kind of elongated lands among the urban fabric which led to some difficulties regarding what to do with these lands. After the decline of the industrial era, cities were changing parallel with the use and design of these lands to create the so-called; Linear parks. Linear parks are defined as an urban or suburban setting that is substantially long and elongated with greenways creating a green continuity in the urban fabric [4]. Those kind of parks are formed as a result from historical features of a city such as roads that were replaced with green spaces. They are ideal for activities or an extension of the urban fabric. They allow number of people to live within close proximity to green space as they stretch through cities.

Urban open spaces and greenways

The term of urban open space as a part of a greenway refers to a space that is connected with high quality maintenance, which is any space that

has no building structure on it and is empty. Can form as an urban space that is located in the urban regions surrounding the city or can be an open space that is an undeveloped piece of land. It has a correlation with the human, standing as a reflection of the human needs and modifications toward natural areas, not to mention the development of the understanding of these spaces and how it influenced the design and style of these spaces which matches with the concept of the greenways as not only for providing urban open spaces but by designing these spaces in a way to serve the community needs. The urban open space is considered as an urban area with a semi-natural ecosystem converted urban spaces by human influence and provided the connection between urban and nature [8]. Urban green spaces in greenways contain the open lands that can be distributed in the urban fabric in many shapes and forms. They also have a function or a purpose for why they are designed as a part of the urban texture. They are open to the public whether they were privately or publicly owned [8].

Ecological sustainability and land revitalization in greenways

In order for greenways to be ecologically sustainable, the structure of the greenways should support the ecological processes that are required for the greenway to deliver biodiversity services for present and future generations. Ecological networks can bridge between reserve conservation (fixed nature in space and time) and development which implies change [7]. The term 'Ecological sustainability' is a new term that is not quite developed in the landscape planning. This was illustrated and mentioned in both Ahern studies [1] and Steiner's book (The living landscape) which demonstrate the ecological approach of landscape planning of greenways [2]. Steiner defined the ecological planning in his book as "the use of biophysical and socio-cultural information to suggest opportunities and constraints for decision-making about the use of landscapes" by taking the sustainability as a landscape goal for landscape development [9]. In order to achieve the combination and stability between the socio-cultural factor and the physical environment, the needs of the future generations should be taking care of and should be compared with the needs of the present. "A condition of stability in physical and social systems achieved by accommodating the needs of the present without compromising the ability of future generations to meet their needs" [1]. Also by achieving a balanced stage between the ecological, cultural and economic functions in order to save the resources for the future generations [5].

Ecological sustainability and ecosystem biodiversity

Ecological sustainability includes all the terms and the parts that are connected to form the whole ecosystem. It is defined as the continuity and the development of the natural resources and the adaptability of species and habitats of the ecosystem including the human effect on the land and the human health. The ecological networks are defined as a set of ecosystems linked together by the flow of organisms, those ecosystems are existed in the landscape as several types and can be for single or multiple purposes [7]. Greenways can form part of the ecological networks mainly forming as linear elements that has a multipurpose use, including aesthetic, recreational and cultural purposes [1].

Public safety and greenways planning

There is always a contrast and a tension between the design of natural corridors and the infrastructure and road system of the city. The planning of safe urban trails within natural greenways can be critical and contentious [6]. Natural corridors may be perceived as unsafe and avoided by people regarding the unclear sightlines that can effect on the ecological integrity. In order to get rid of the idea of unsafety in greenways, the term '**Human ecology**' should be understood regarding the fact that this term refers to the relationship between the human and the environment. people will be expected to interact with the open space in such a way as to maximize their well-being, including their physical safety and their social, psychological and physical comfort [6]. The spatial design of the open spaces creates a mental image and a cognitive map in its users' minds and that what enhances the perception and feeling of safety and security in spaces which leads to increase comfort and enjoyment [3].

Research Gap

The absence of the nexus between the heavily city growth and serving the needs of people is deemed an approach for urban and social failure, not to mention the need to protect the agricultural lands. The study focuses on the importance and outcomes of proposing solutions to achieve a balance between the uncontrolled urban expansion and land protection in order to serve the community needs by examining a development of a greenway along a commuting route; the so-called, "Petra street" which is located in Irbid City-Jordan and connects the historical downtown of Irbid city toward Jordan university of Science and Technology; "JUST". Petra street is not only considered an important traffic connection, but also is forming a significant linear element in Irbid city that connects the agricultural lands surrounding it. According to the refuge waves since 2011, the increase of the population and the expansion of Irbid city, the urban

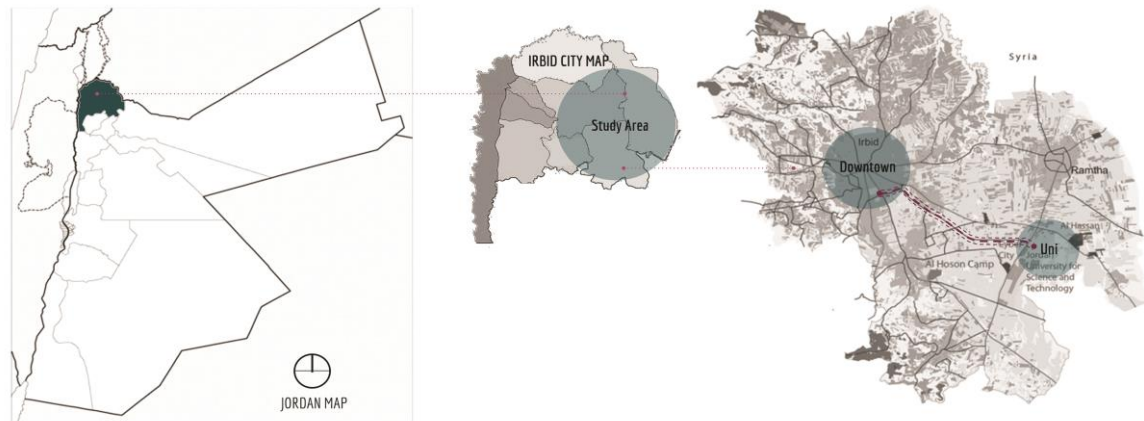


Fig. 1. Share'e Al Petra – Petra Street Study Area Location [Ansam Bzour]

development started to expand in a chaotic distribution toward the route which makes it difficult to provide people with open recreational spaces and protect the existed lands [10]. The chaotic expansion caused a huge loss of the agricultural lands and products among the route.

Research Objectives

In order to rectify and fulfill this research gap, the goal of our analyses is developing a sustainable way to maintain the connection and the balance between the city growth and the protection of the land agricultural quality not to mention serving the community needs and reflecting the identity that demands a clear study of the existing state of the city and the future proposed plans that should be directed to focus on the cultural needs by studying the social patterns and implementing the public opinion. Not to mention examining the development of a greenway proposal in order to test the various outcomes on the development of the city. Both should work together to result in a city that performs as a more flexible for change. In order to inspect the impact of a greenway development on the city planning and highlighting the identity of the city structure and city development, variables should be analyzed while studying the existed route. The proposed greenway is expected to help in revivng the existed neglected agricultural lands to serve the society needs firstly by defining the existed types of the lands and examine the quality of the soil and then starting to propose the suitable solutions such as developing linear parks that have social services and activities to help in achieving the social community needs and proposing a future plan to manage the urban biodiversity. A way of enhancing the social sustainability is to pedestrianize the area and make it more walking friendly by creating linear developed pedestrianized routes and cycling routes that have attractions and open spaces that serve the community needs and enrich the human experience. Another very important planning method that can help in monitoring the anarchic expansion is to study

the traffic connections and the existed road system and to develop a long term plan to serve the vehicle movement and road connections in order to help in solving the traffic jams.

Materials and Methods

Research analysis of the study is based on key topics regarding the establishment of greenway and land quality in the city of Irbid. The study area is located in the south east of Irbid City, forming the connection between the historical downtown extended through a route to Jordan University of Science and Technology. The study aims to analyze and develop the so-called route (Share'e Al Petra – Petra Street). (Fig. 1). The research part is based on theoretical research papers and books, which influence the planning approach. The analysis was made on two different scales; the study of the macro scale with the help of GIS base maps and municipality archives and on the micro scale done by several site visits and observations with professionals. Considering the locals' participation in the study formed an essential tool for the development of the greenway, a hundred interviews and surveys were distributed to the locals and took place in order to deliver their opinions regarding the development of the route. 60 % of the surveys were distributed manually to the residents who live along the route, a 30 % for the employees who work in the municipality of Irbid City and the last 10 % was given to landscape architects who work in the field of urban planning and landscape architecture.

In order to fulfill the real vision of understanding the site, the analysis was projected to be made on different urban and social aspects to meet the study objectives. Studying and analyzing the road infrastructure regarding the ecological aspect by analyzing the green corridors maps in the whole region forms as essential tool during the study process. Route analysis, history development and accessibility help in enhancing the results quality and the development of the study area.

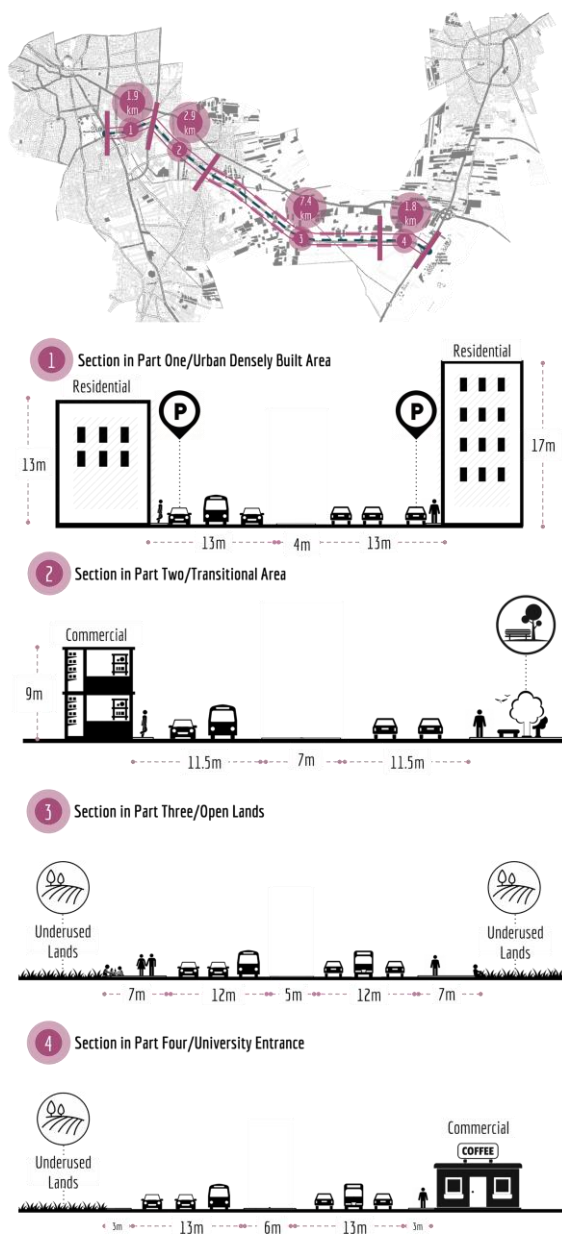


Fig. 2. Study area division method - Iconized sections
[Ansam Bzour]

Focusing on the importance of engaging the community in the decision making process benefits in developing the nexus between the society and their lands and helps in delivering their needs. In order to achieve the social participation in this study, the analysis of the behavioral patterns and social aspects formed a great tool by creating online and personal surveys that meet the understanding level of the community toward the site and studying the cultural aspects and traditions by talking to local people and meeting professionals.

According to the site visit, a method of dividing the study area into four different parts regarding the change in the character and atmosphere was applied in order to come up with detailed analysis and

understanding of the route parts. The first part, which is 1.9 kms, starts from Yarmouk university until the so-called Culture Square. This part is characterized by urban density, heavy traffic thanks to the commercial facilities such as malls, the transportation complex (Amman Complex) and the existence of the university. The common typology of the buildings there is mainly forming as a multi-story residential building.

The second part starts from the so-called Culture Square and ends next to Sareeh traffic sign. This part is shaped as a transitional zone between the densely built up areas and the open lands. It has less urban density than the first part but the heavy traffic continues in this part as well. It is 2.9 kms in length.

The third part forms a selected study area where a deeper analysis was done regarding the goals of this study. It has a length of 7.4 kms and mainly consists of open underused fertilized lands and grasslands. The traffic in this part is less than in the other parts and is mostly limited to users who commute to the university such as students or workers, and to some residents of the surrounding areas. The last section extends toward the entrance of Jordan University of Science and Technology. This part is the most developed in comparison with the other sections of the route. The traffic in this part is heavy, given the proximity of the university entrance. The next figure shows the division of the four parts in plan view (Fig. 2).

Two factors were essential in determining the width and extension of the greenway proposal. After analyzing the topographical formation and ownership of the lands, those two factors formed the key in order to define the edge of the greenway development. The greenway implementation were based upon the lands that share a similar topographical levels with the main traffic route. Another focus was to develop the greenway proposal mainly on the lands that are owned by the government which makes it more applicable for changes. The lands that are owned by the government form a less percentage of the overall area than the lands that are privately owned, yet succeed in maintaining the goal of the greenway proposal.

Results and Discussion

The reason behind the importance of the urban growth control is regarding the continuous increase in the number of population that may effect on the quality of recreational and agricultural facilities. Throughout history, the land of Jordan and especially Irbid City has renowned for its luxurious vegetation and wildlife [11]. Yet, Irbid City has suffered from the rapid change of the number of population and the continuous need for habitats which makes it the third most populous city in Jordan according to the archives of the department

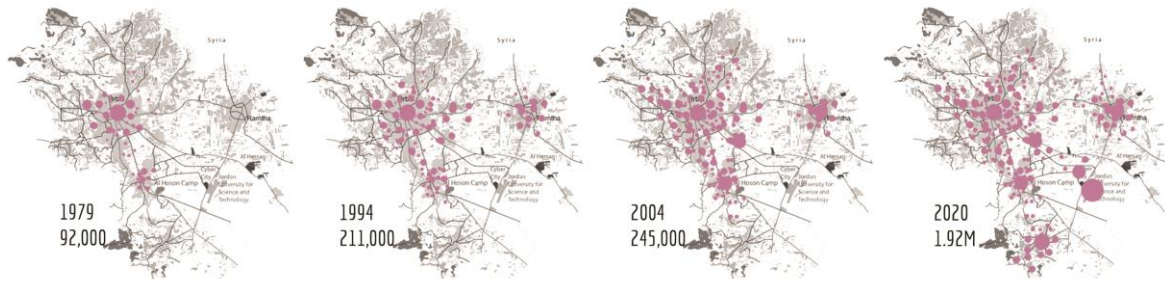


Fig. 3. Population growth in Jordan [Department of Statistics Data-Jordan]

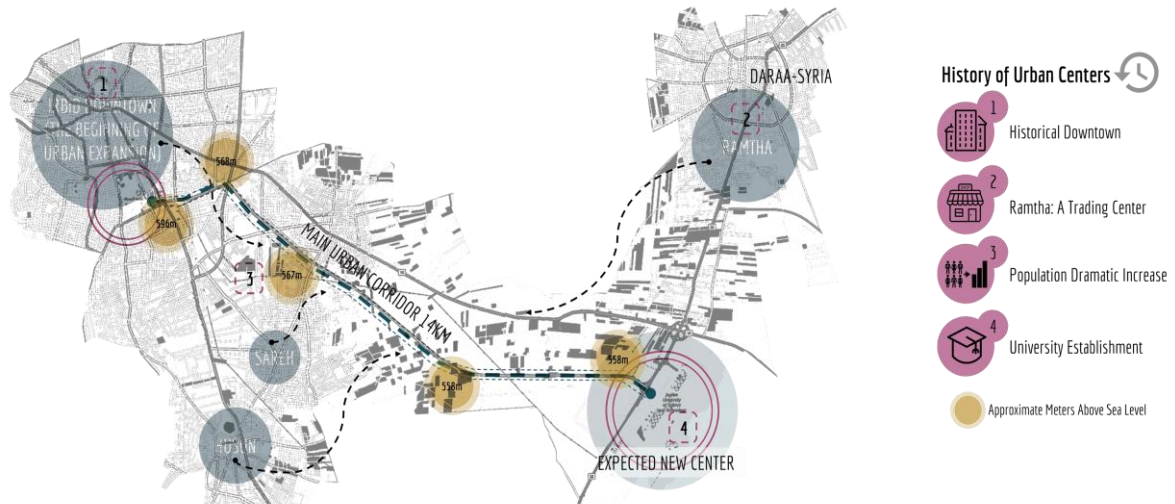


Fig. 4. Urban growth and expansion in the study area [Ansam Bzour]

of statistics, having grown in density dramatically since the 1970s [10] (Fig. 3).

Understanding the city is achieved by understanding the urban development and distribution of built elements. This can be progressed by analyzing the urban expansion and the changes in the city structure and character. The study is focusing on these changes by creating an assessment plan regarding urban aspects. Looking back through history and following the municipality archives and historical maps, the study area has passed through multiple changes regarding the urban expansion and the number of population there [10]. The downtown of Irbid was the first center in the city after the Ottoman Empire, leaving the area with many historical ruins that belong to the Ottoman and Roman colonizations. People started to settle there, as the downtown of Irbid was considered to be the highest point at that time. On the other hand, the Northern part of Irbid started to be formed as another center regarding the strategic commercial location next to Dara'a – Syria. The formation of this center was mainly due to trading purposes: many shops and trading markets started to appear, and the first urban settlement began to exist. After that, the number of population has increased as a result of the refuge wave. That was the case after the establishment of Yarmouk University South

to the downtown, which led to a huge internal refuge wave of students who moved from their villages to live next to the university. This directed the urban expansion toward the university area from the city center and formed new small centers; Husun and Sareh centers [10]. The figure shows the urban growth and expansion in the study area (Fig. 4).

The lands on both sides of the route are believed to have been quite important agricultural resources [11]. The degradation in the quality of the lands and the lack of public open spaces resulted in the huge need to revive the neglected lands and enrich the land biodiversity and sustainability. Deep urban analysis was made in the third section of the route using personal observation through multiple site visits to come up with results that benefit the ecology and biodiversity of those lands. The study of the solid and void helped in showing that the area is divided into different typologies and forms according to the distribution of urban expansion. A division was made to focus on the different characteristics of each part illustrating that the study site starts with a very densely built up area with privately owned lands, and keeps changing to gradually becoming more open with scattered built up areas which strengthen the importance of the route forming a great potential as an open linear element for the city that needs to be planned to serve

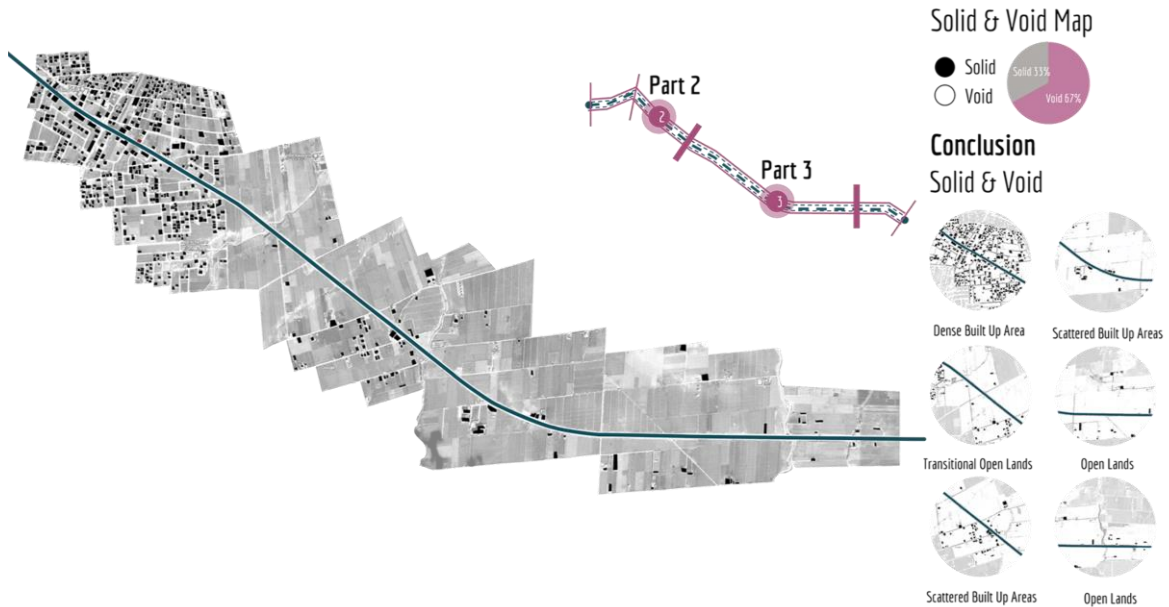


Fig. 5. Solid & Void in the study area [Ansam Bzour]

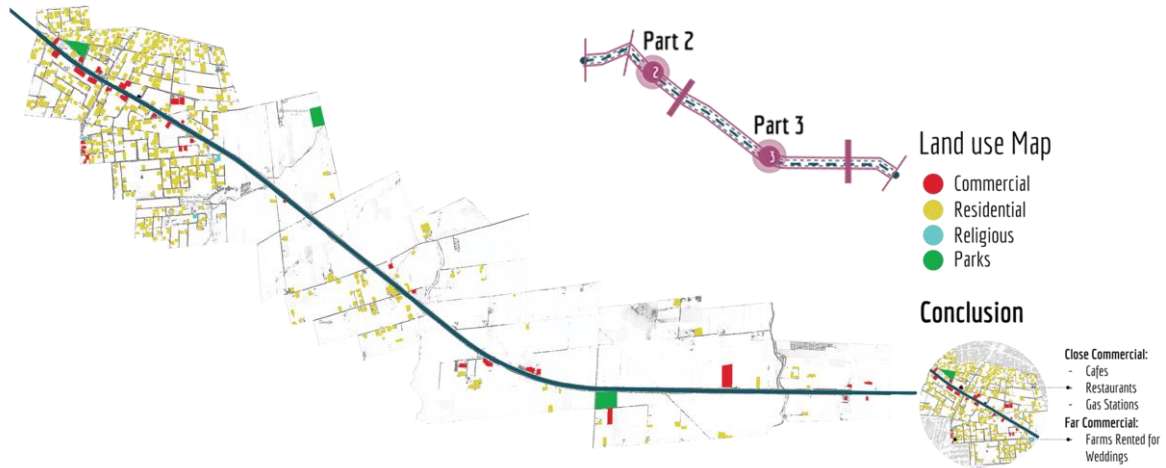


Fig. 6. Land use analysis of the study area [Ansam Bzour]

as a breath out and a facilitated route to serve the community and the city structure (Fig. 5).

The analysis of the land use in the study area based on the GIS basic maps helped in detecting the main functions of the buildings along the route. The buildings that are located closer to the route are mainly functioning as commercial buildings which provide facilities for commuters. Going further from both sides, the function of the buildings changes to become residential with privately owned lands, used primarily in agriculture [11]. Only three small parks were found and two of them are privately used. This shows the huge lack in recreational facilities for the public (Fig. 6).

During the site visit the analysis was made to demonstrate the types of lands by testing the type of the soil in order to know which is more developed than the other. This makes the application of the strategy to develop the lands and achieve the goals more efficient. The result of this analysis illustrated

that the lands next to the route have a rich fertilized red soil and are divided into three types: agricultural land, recreational land - whether privately or publically used-and fertilized lands that are mainly underused. Also, it is important to mention that the route itself is forming three different typologies according to the land analysis; starting from the urban then intermediate and finally going toward the partially rural lands (Fig. 7).

In order to respect the guidance when designing, eliminating or applying changes in a city texture, and to understand the types of roads and the structure of the city, analysis of the traffic and the junctions is really important. The post-analysis map illustrates the types of roads in the study area, as it defines the location of the undeveloped roads and the type of the transportation used. Also, zooming in some sections has been used to show the direction of the traffic. The result reflects that most of the junctions are undeveloped, the sidewalks are not in



Fig. 7. Land typologies of the study area [Ansam Bzour]

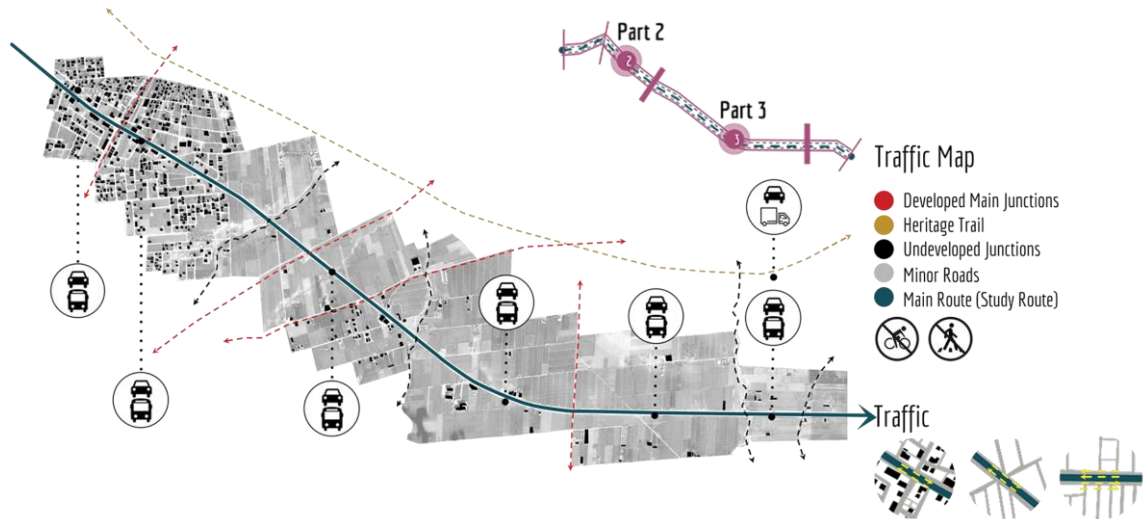


Fig. 8. Traffic analysis of the study area [Ansam Bzour]

a good pedestrianized condition and the route is not provided by bicycle lanes (Fig. 8).

As a result of the analysis, a SWOT map was developed in order to illustrate the strength points in the study area which appear as open lands in a highly built up metropolitan city that people use continuously which show a great potential to serve the community needs as open recreational areas. Some of those lands are distinguished by a good soil condition and quality that form as a suitable base for agriculture. However, the agricultural products quality is degrading which gives a chance to set a data base to improve a long-term plan with the owners and the farmers to manage the agricultural production.

Moreover, enhancing the quality of the road system and managing the weak traffic and connections along the route helps in creating a better environment and contributes in engaging the community with the area, not to mention that it strengthens the value of the lands and makes it more

welcoming to locals by providing the necessary requirements to become more as a pedestrian friendly route.

As mentioned by Ahern J. in Greenways as Strategic Landscape Planning [1], the greenway implementation focuses on enhancing the ability to monitor the city growth by strengthening the protection of the lands and proposing functional or physical changes in order to suit the needs of the community which was formed as potential opportunities that were reflected and illustrated in the SWOT analysis study as it showed similar recommendations and outcomes as described in the study of Ahern J. such as proposing some recreational activities that are required from the locals and recommending the vertical urban expansion in order to manage the city growth and provide a more horizontal openness for the area. However, a huge focus needs to be added on the importance of engaging the community in the changes and modifications of the lands as the public

opinion of any changes that occur in the surroundings should be taken into consideration.

The proposed greenway will benefit Irbid City into making it more flexible for change and adaptable for new proposals and implementations by providing a network base that develops linear elements and connects the lands in between them, not to mention forming as a base for the future ecological development of the city which was focused on in the study of A Tale of Two Trails by Keith [12] on how to consider a greenway as a tool to enhance the structure of the city to which it forms as the base layer for any future development, adding on that the development of biodiversity and the revitalization of the lands surrounding the greenway.

The proposal of a greenway in Irbid City is expected to be a double-edged sword regarding how the community will perceive it and be ready for changes since most of the lands surrounding the route that forms the base for the greenway proposal are considered as privately owned and those changes in the adjacent lands may push some problems to occur regarding the adaptation for the process of modifying the adjacent lands. Although the proposed urban areas are set to meet the community needs which agrees with what is mentioned in the Terminology of Urban Open and Green Spaces [8], according to the survey that was distributed on the residents of the study area it was quite noticeable that many people had a difficulty in understanding the term of greenway proposal and the process of implementing it which raises the importance of focusing on engaging the community in the process of change.

Study Recommendations and Conclusion

Creating unity and consistency between the urban expansion and land protection is important to understand that urban planning must be monitored and controlled equally and parallel between the two directions. The study benefits in the implementation of new proposals of introducing the concept of greenways as a tool to save the scattered lands and regulate the urban development of the city. It helps in presenting the importance of considering the community needs when providing change in the urban textures of the city as well as contributes in regulating the direction of the urban expansion by preventing the chaotic and unplanned urban decisions which develops a base for the future development of the city. This study contributes in highlighting the need and importance of urban and city planning. Urban analysis of Irbid city helps in discovering the demands of the city yet the problems facing the community and people who live there regarding the lack of natural resources and

recreational facilities beside the degradation of the agricultural lands value as shown in the analysis of the existing state of the route.

In order to develop a spatial entity greenway, a strategic vision should be made to demonstrate the main points that should be considered in the design process. The strategic vision should mainly focus on sustaining the lands by redeveloping the agricultural lands and improving the lands that contain fertilized soil in order to be maintained in the future. Moreover, to integrate the society with the value of these lands by developing methods to enhance the social sustainability and providing people with recreational facilities in order to form the greenway as a breath-out for the city. And finally to maintain the mobility connection and the vehicular flow between the old center and the expected new one. The continuous focus on the consideration of the influence and effect of implementing and planning a greenway project in the city helps in expand the process of developing cities in a more dynamic and directed way.

The implementation of a greenway in the study area helps in providing the need of the existed agricultural lands by planting native plants that enhance the biodiversity and strengthen the ecological aspect of the lands. Developing a greenway contributes in proposing a development of functional modifications on the lands that suit the community needs of the area and open up the direction of the urban expansion in a more controlled and monitored way by managing the road system and network along the route and finally providing recreational activities to serve the needs of the local community.

According to the outcomes of the survey that was distributed on the users, the majority of the participants have voted for having more recreational activities along the route that serve their daily needs. Not to mention the importance of maintaining the role of farmers and the connection between them and their agricultural lands by providing sustainable work plan to harvest and improve the land quality and to engage the local community in the importance of being part of the agricultural recovering process.

Proposing a greenway helps the city to grow both naturally and rurally by highlighting and developing the natural resources and protecting the areas of habitats and wildlife. Moreover, it gives an easy access for the community use by providing their needs which can form as a vent for the development of both natural quality and social sustainability by providing attractions that are connected with pedestrianized and cycled routes to enhance walkability.

And finally, the proposed greenway will definitely fix and rearrange the road network and system in order to play a role in directing the city growth by solving the existing traffic problems and preventing future ones.

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Kopsavilkums. Zaļie koridori ir pilsētas elementi, kuru mērķis ir parādīt lineāro konsekvenci un savienojamību starp atklātām zaļajām zonām un attīstīt pilsētas faktūru. Pētījuma mērķis ir iepazīstināt ar “zaļā koridora” attīstības modeli, lai tas darbotos kā prototips esošā maršrutā Irbidas pilsētā (*Irbid*), Jordānijā (*Jordan*). Objekta apmeklējuma laikā izmantotas maršruta pārbaudes, analīzes metodes un ĢIS bāzes kartes. Irbidas pilsēta atrodas Jordānijas ziemeļu daļā ar radiālu pilsētas paplašināšanās modeli, kas stiepjas no vēsturiskā centra un izplatās pilsētas nomalē. Pētījumā konstatēts ievērojams iedzīvotāju skaita pieaugums Irbidas pilsētā kopš pagājušā gadsimta 70-desmitajiem gadiem līdz mūsdienām. Pilsētas iekšējā daļā tika īstenots milzīgs skaits mājokļu projektu, kas paplašinājās līdz ārējai daļai, ieskaitot lauku teritorijas. Antropogēnās slodzes rezultātā konstatēts, ka šobrīd iztrūkst lauksaimniecības zemes un atvērtu atpūtas telpu, no kurām cilvēki varētu gūt labumu. Zaļā koridora izveidošana analizētajā maršrutā palielinātu integrāciju starp cilvēkiem un viņu zemēm, kas veicinātu lauksaimniecības attīstību, kā arī nodrošinātu labvēlīgākus pilsētas attīstības procesus Irbidas pilsētā.