

Article

Space Syntax and Urban Morphology in Historical Context: Mapping Green Space Systems in the Hungarian Part of Habsburg Central Europe

Éva Lovra ^{1,*}  and Elif Sarihan ² 

¹ Department of Civil Engineering, Faculty of Engineering, University of Debrecen, Ótemető Street 2–4, 4028 Debrecen, Hungary

² Geoscience Doctoral School, University of Debrecen, Egyetem Square 1, 4032 Debrecen, Hungary; elifsarihan@mailbox.unideb.hu

* Correspondence: lovra.eva@eng.unideb.hu

Abstract

The research examines the evolution of urban green spaces within Habsburg Central European cities. It analyses how the Austro-Hungarian Compromise (*Ausgleich*, 1867) was associated with urban planning and integrating green space into existing historical urban fabrics. The study combines urban morphological analysis and space syntax to compare historical and contemporary urban structures. It identifies the historical factors, including early modern urban planning, relevant legal frameworks, and the emergence of landscape architecture, that associated with the formation of these green networks. Focusing on the late 19th and early 20th centuries' green spaces in Bratislava and Novi Sad, the study defines the spatial integration of urban green spaces within the built form to represent the change in the urban fabric as a whole. It reveals patterns in their integration, accessibility, and association with urban fabric development, contributing to understanding of Central European urban evolution, planning, and green space distribution's influence on contemporary towns.

Keywords: Austria-Hungary; urban green spaces; urban morphology; space syntax

1. Introduction

The primary focus of this research is the urban morphological and space syntax analysis of green spaces (primarily parks and gardens) and their systems within a planning-historical context. A characteristic feature of European cities is that the proportion of green spaces within historical city centres is low compared to built-up areas, with green spaces later integrating into the historical urban fabric. Thus, urban development, in the context of green space evolution, carries a unique pattern defined by local specificities.

Our research aims to investigate the historical development of urban green spaces and their association with contemporary cities, examining the guiding criteria for their establishment, including considerations of representation versus public health. We investigated green spaces as discontinuous fringe belts [1]. Through space syntax analyses, the study will explore how the spatial integration of green spaces has evolved within urban structures from the Austro-Hungarian period to the present. The research seeks to determine the association between green space location and accessibility on the ongoing urban tissue development of contemporary cities.



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Following Austria's defeat in the Austro-Prussian War of 1866, the terms of the Peace of Prague (Praha, CZ) compelled the Austrian Empire to renounce its leadership in the pursuit of German unification in favour of the Kingdom of Prussia and to withdraw from the German Confederation. This geopolitical shift catalysed the constitutional reconciliation between the Kingdom of Hungary and the Austrian Empire. The resulting compromise agreement of 1867 (Austro-Hungarian Compromise or *Ausgleich*) established the dualist state structure of Austria-Hungary as a political union of two sovereign entities defined by distinct constitutions and two capital cities.

The Industrial Revolution, particularly the post-1867 era, precipitated a radical departure from traditional settlement patterns, introducing profound changes to urban morphology and the built environment. Between 1867 and the outbreak of the First World War, the modern structural character and spatial configuration of cities within historical Hungary and partially in the Austrian part were firmly established. Driven by the economic surge and burgeoning capitalist development of the late 19th century, industrial and commercial hubs—functioning as primary nodes in the transport network—undergoing rapid expansion. This growth, alongside significant demographic transitions, resulted in a fundamental realignment of settlement hierarchies.

The modernisation and structural restructuring of these urban centres reached an initial zenith during the Austro-Hungarian era. The decades spanning the turn of the 19th and 20th centuries were particularly instrumental in defining the modern aesthetic and structural organisation of these cities. The urban tissue (or morphological regions) established during this period continues to represent a primary component of the contemporary urban heritage. These inherited urban structures and the surviving built environment constitute a prestigious legacy that remains the defining characteristic of the region's visual and functional identity [2].

The Austro-Hungarian period introduced a cohesive model characterised by high-density perimeter blocks, radial-concentric street hierarchies, and clearly defined public-private demarcations. These historic districts formed a resilient urban skeleton that subsequent developments have either harmoniously extended or radically disrupted. While early 20th-century expansions largely adhered to the established grain, the mid-century introduction of large-scale prefabricated housing estates represented an 'alien' morphological insertion. By abandoning the traditional street-front alignment in favour of autonomous, open-row planning, these estates created a structural disconnect with the inherited 19th-century fabric. Consequently, contemporary urban planning in the region is now defined by the dual challenge of preserving the heritage of the Austro-Hungarian era while attempting to functionally and aesthetically reintegrate these disparate, mid-century layers into the broader urban continuity [2].

This study examines selected cities of the former Austria-Hungary using urban morphology and space syntax methods, analysing their historical and contemporary structures, urban fabrics, and natural and built environments. The research combines urban morphological analysis with the identification of historical driving forces of development. The morphological study defines urban green space as an urban fringe based on Whitehand [1] and classifies urban fabric types according to Lovra [2]. It further employs space syntax analysis to compare former city structures with their present state. A key innovation here is assigning an integration value to the spaces enclosed by streets, a factor often absent in traditional space syntax studies. The historical analysis focuses on the emergence of modern urban planning and its legal frameworks (building codes) in historic Hungary as a constitutional part of Austria-Hungary. Central to this is the work of Antal Palóczy, a founder of early modern urban design during the Austro-Hungarian era. Finally, the study

examines the rise of new disciplines, specifically urban design and landscape architecture, as constitutional parts of this development process.

The study of the past and present integration of green spaces (space syntax) also reveals the transformation of the spatial structure not only in the immediate vicinity of the green space but also throughout the entire urban area. Integration is the calculation of how close individual spatial elements (in this case, green spaces) are to each other, and how accessible they are to others according to various distance definitions. The selected cities, like Bratislava (SK) and Novi Sad (RS) [3], were located in historic Hungary in the period of Austria-Hungary (1867–1918). A complex examination of the historical and current urban structures of the selected cities thus uncovers regularities, patterns, and correlations within the context of green spaces—urban structure and development—in the narrower Central European region, namely in the former Habsburg Central Europe [4] (p. 11).

The accessibility of green spaces, which form part of the urban landscape and represent the natural environment at various scales, was closely related to their development. Historically, the accessibility of urban green spaces has been primarily associated with their evolution and functional integration within the urban structure. The late 19th-century need to enhance public access to recreational areas was part of the urban planning policy which focused on public health, and it was a catalyst for the expansion of transportation infrastructure. Newly established parks and gardens were typically developed along new roads. The increasing demand for creating green spaces can also be observed in the process of transforming market squares into parks, which remained open areas despite the dense development of cities. The emergence of the first urban railways was linked to the connectivity of green fringes to the urban core, attempting to provide easier access to urban parks, effectively shrinking the topological distance. This historical notion of accessibility is not merely a function of proximity, but of spatial configuration. In this study, we quantify this relationship through space syntax integration analysis, as we can model the interaction between the built environment and the natural landscape and measure how embedded a green space is within the urban fabric.

Urban green spaces serve as a measurement for understanding the spatial-temporal evolution and spatial integration of a city's urban fabric. The study examines historical green systems to identify the foundational factors that correlate with contemporary urban development. Historical approaches reveal how the alignment of streets and the creation of parks were used to loosen dense urban blocks and improve public health. The study of past integration reveals how the spatial structure transformed not only in the immediate vicinity of green spaces but throughout the entire urban area over time. The results of the study offer several key contributions to the broader field of urban studies and planning. The research fills a gap in historico-geographical approaches by identifying green space as an individual, measurable element in urban structure analysis rather than just a secondary feature. It introduces a new factor to traditional space syntax by endowing the space enclosed by streets with an 'integration value,' allowing for a more nuanced quantification of how green spaces adapt to urban systems. By uncovering regularities in how green space location and accessibility are associated with ongoing urban tissue development, the study helps understanding the potential direction of transformation in contemporary towns.

2. Methodological Combinations—The Role of Urban Green Spaces in Urban Morphology and Space Syntax Analyses

2.1. Conceptual Background

In urban studies, the placement of parks and green areas within cities, their intra-urban distribution, and their relationship to various urban tissue types are significant for defining urban green spaces. The urban tissue is a synthesis of elements like streets, spaces

(including green space), and buildings, to understand the physical characteristics and character of the city. Green areas within cities can include parks, gardens, and tree-lined avenues, as well as green spaces located at the city's periphery (recreational areas, or areas integrated as part of the city's expansion). The definition of green spaces partly follows Josef Stübben's classification [5] (pp. 161–170) in the case of our research.

Stübben analysed green space systems, which he called Gartenplätze (garden squares/places). He used the term *Platz* to describe both public squares and green spaces, including avenues. His handbook had two significant sections: *Gartenplätze* and *Architekturplätze*, which studied the relationships and types of public buildings and open spaces. Stübben examined variations of public spaces within an open place, specifically their relationship to a particular building or complex. He approached urban spaces from an urban planning perspective. He differentiated urban green spaces, or *Gartenplätze*, and dedicated a chapter to their analysis and typology. He defined the concept and criteria for each type of green space, including planted streets, planted squares, and parks. He also discussed additional types like ornamental parks and recreational areas. A park was defined as a continuous green area, with types including city gardens, people's gardens, city parks, civic parks, and city forests. The *Gartenplatz* manifests at various levels of planning, encompassing tree-lined avenues, parks, or tree-filled urban squares.

2.2. Integrated Morphological Approach

Urban morphology, as a discipline, investigates the tangible elements constituting urban form, such as streets, buildings, and plots (the constituting elements of the urban tissues), and the various agents and mechanisms responsible for shaping this form [6].

Over the past decade, the study of urban green spaces has increasingly incorporated an urban morphological perspective, as noted by Zou and Wang [7], building on the work of scholars such as Whitehand [8] who consider the urban green spaces as the urban fringes or urban fringe belts (concept by Whitehand [1]). According to M. R. G. Conzen, the fringe-belt is "a belt-like zone originating from the temporarily stationary or very slow advancing fringe of a town and composed of a characteristic mixture of land-use units initially seeking peripheral location" [9] (p. 58). A significant proportion of urban green spaces are found in fringe belts. Fringe belts are belt-like zones (continuous or discontinuous) that form at the urban periphery during periods of slow or no urban growth. These can be continuous, often originating adjacent to former physical limitations like city walls or topographical obstacles, or discontinuous, often related to hiatuses in urban growth such as slumps in housebuilding. In Whitehand [8], the "continuous green-space fringe belts" and "discontinuous green-space fringe belts" are discussed and differentiated. Examples of continuous green-space fringe belts include the *glacis* around city walls. These spaces, particularly within the intramural inner fringe belt (the area inside the city walls), are integral to urban identity and heritage [10]. Whitehand, in his editorials of the journal *Urban Morphology*, highlighted that while urban morphological research has largely maintained its focus on physical structures over the last two decades, the broader field of urban studies has, in contrast, seen a significant rise in interest in spaces, notably green spaces, during the same period [11,12]. The growing recognition of the significance of green spaces is for various reasons, including psychological and visual comfort, ecological functions, and social cohesion. The Viewpoint by Whitehand [13] on "green space, fringe belts and the historico-geographical structure of cities" states that "Greater appreciation is needed of the role of these spaces in physical expressions of phases in the development of the historico-geographical structure of cities" [13] (p. 106). In recent years, starting from Šćitaroci and Marić [10], studies by Zhang [14], Kahouei and Cömert [15] have aimed to fill the gap "in historico-geographical and process typological approaches in order to

examine the possibility of identifying ‘Green Space’ (GS) as an individual element in the urban structure” [15] (p. 135) and how greenery in urban morphology impacts green space accessibility [16].

Utilising an integrated urban morphological approach, the research will characterise the relationship between green spaces and the built environment across the era of the Austro-Hungarian Monarchy. Lovra [2] defined the methodology as a combination of the historico-geographical and typo-morphological approach in urban morphology, focusing on how characteristic urban tissue types were defined in these towns. The urban tissue typology (catalogue) was created by comparing and analysing the urban fabric of seventy cities in the former historic Hungary. The typology does not account for minor variations, focusing only on dominant type characteristics. Eleven main urban tissue types and overall forty-one urban tissue types (characteristic for the Habsburg Central European period) were identified using the integrated urban morphology method, which can be divided into main and sub-types. The integrated morphological method utilises and combines Conzenian cognitive morphology with elements of Caniggian urban morphological practice, that is, a method for understanding urban forms through the historical processes that generate them. The steps for defining urban fabric using this method are: (1) defining the street network and street network patterns, followed by (2) defining plots and buildings, as well as their relationship (with each other and with the street network). (3) This is supplemented by the examination of plot systems and (4) associated complementary spaces (vacant spaces and areas belonging to blocks), green spaces, and open spaces. The elements of the method include: plot; streets and their systems; urban fabric; zones; morphological regions and townscape; and it also takes into account the factors in the formation of patterns, defining them accordingly.

To represent changes in the urban fabric as a whole, it is important to examine the spatial accessibility of urban green spaces within the built form. This can be achieved using axial maps by calculating the spatial integration of the street network within the built environment relative to all other spaces. Thus, the continuity in the urban fabric can be analysed using axial maps in relation to the location of urban green spaces. For this purpose, the study focuses on the position (location) of green spaces within each selected city.

The existence of urban green spaces in urban landscapes is an important measurement to understand the spatial-temporal aspects of urban structures. These structures are shaped by the integration of different components of the urban form over time, which define the urban environment. The space syntax theory, developed by Bill Hillier and Julienne Hanson [17,18], uses streets as the integration dimensions (components) of urban spaces. By creating axial network maps from streets and their interconnections, changes in the configurations of urban elements over time can be quantified and interpreted through space syntax analysis. In this context, space syntax analysis is used as a method to effectively analyse and interpret the spatial and temporal integration of urban green spaces in their adaptation to urban systems. Thus, the integration analysis of axial maps, where spatial integration represents the highest or lowest values, is performed to reveal the potential effects of urban green spaces on spatial configuration.

The case study analyses will include building regulations, urban planning history, and urban plan analyses based on primary (archival) sources and thematic journals and newspapers from the period of formation to the present, to provide a profound understanding of the building endeavours of the late 19th and early 20th centuries.

2.3. Data Sources

This chapter outlines the types of the data sources used and the methodological framework. Given the research focus on the combination of urban morphological analysis and space syntax, the data collection procedure follows the different types of analysis employed in this study. The data structure is organised by the three types of data:

- Historical cartographic maps (historical context)
- Urban Atlas/Copernicus Land Monitoring Services (the geo-located position of the urban green spaces)
- OpenStreetMap (OSM) road network (space syntax axial analysis).

2.4. Data Preparation and Data Processing

To identify the geo-located position of the urban green spaces, we loaded Urban Atlas data into QGIS [19] and intersected it with the derived road network data from OpenStreetMap (OSM) [20]. We filtered green spaces attributes and extracted green spaces polygons from Urban Atlas 2018 land cover and land use vector datasets, available from the Copernicus Land Monitoring Service [21]. Retrieved green spaces data from Urban Atlas is a composite attribute, constructed by position-based indicators; that is why it needs to be reclassified (predefining their position) to make their integration meaningful and interpretable. We determined green space types based on their historical developmental stages, where green spaces are remnants or resulted from the fringe belts due to stagnation periods in urban fabric expansion. Three types of fringe belts—inner fringe belt, intermediate fringe belt, and outer fringe belt—are identified based on the continuity of the urban green fabric within the physical limitations of urban growth. After this process, we applied georeferencing to ensure the accuracy of the coordinate systems of the obtained historical maps and to perform the spatial data integration of historical sources with Urban Atlas and OSM data sets. Once the maps have been georeferenced, we digitized the location/position of the green spaces into point shapefiles and assigned attributes to green spaces points is found in urban fringe categories.

2.5. Data Analysis—Space Syntax Integration Analysis

The study utilized “Axial map” analysis for the spatial configuration from cleaned OSM street network data layer in QGIS. Spatial Integration values were calculated using the Space Syntax Toolkit plug-in (DepthmapXnet-0.35 software) [22] and subsequently analysed in QGIS to generate quantitative indicators and quantitative mapping of the spatial system in relation to current urban green spaces via overlapping layers. Interpretation of the changes in urban fabric mainly focuses on the overlapping georeferenced historical maps without neglecting the traditional descriptive approaches to urban morphology. As an indicator of spatial accessibility, global integration (Radius n) was calculated on the axial map to measure configurational accessibility within the entire system. In the analysis, the colour “Blue” represents the highest integration score, while the colour “Red” represents the lowest integrated areas, which are much less accessible and less connected to the urban fabric.

The axial representation was used for the analysis as the scope of the research is to understand the spatio-temporal changes rather than angular choice behaviour. Therefore, global axial integration (Radius n) was considered as the main indicator, as it is more appropriate to explain large-scale spatial and structural embeddedness of urban green spaces while urban development continues to evolve and their potential to create larger geographical pattern extensions.

2.6. Spatial Linking Procedure

To simplify spatial operations and enable spatial analysis and statistical comparison, a spatial linking procedure (Figure 1) was applied to connect two different types of layers—lines (axial) and polygons (urban green spaces). For this purpose, the centroid of the polygonal-shaped urban green spaces was generated in QGIS. Each centroid was then assigned the global integration values of the nearest axial line, based on shortest metric distance, which allowed interpretation and comparison of the spatial integration values in relation to different fringe types and their degree of integration within the built environment.

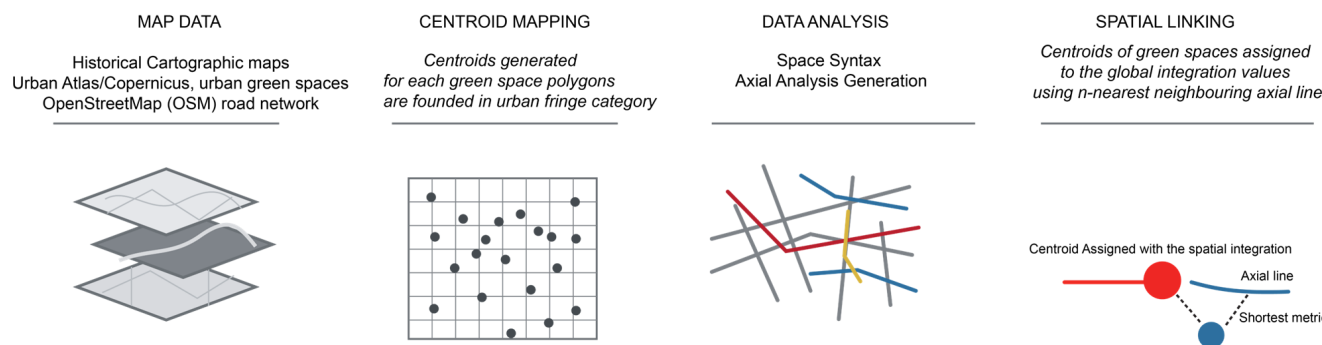


Figure 1. The procedure of the spatial linking to evaluate the spatial integration of each urban fringe green space in relation to the axial line.

2.7. Quantitative/Statistical Comparison Analysis

Statistical analyses were conducted in Python 3.10, Jupyter Notebook 7.0.8 environment to compare integration values of fringe belt types and for the visualisation of the change. The obtained data results from the spatial linking procedure consist of numerical variables describing spatial integration and categorical variables indicating urban fringe categories and temporal structure. The statistical results are demonstrated with box plot analysis.

3. Urban Green Space as Part of the Modern City Idea in the Turn of the 19th and 20th Century

Comprehensive urban development plans required accurate surveys of cities, a practice that only gained widespread adoption from the early 20th century. Prior to this, and even after, regulations often focused solely on smaller areas, leading to misaligned boundaries during separate planning processes. City maps and planning regulations from the second half of the 19th century provided a suitable foundation for the initiatives that transformed cities into modern metropolises. Gyula Éhen’s work, *The Modern City (A modern város)*, published in 1897, outlined the key conditions for creating a modern and liveable city. Regulations, public health, and urban planning were all important, but he also emphasized the importance of establishing green spaces. He wrote, “Planting tree-lined avenues and establishing parks not only comply with the law but also serve the public health of its citizens” [23] (p. 97).

An investigation of this period is essential, as it saw the formulation of urban planning and building legislations that were closely linked to the development of both the built environment and green space planning. These frameworks were significantly associated with urban green spaces at the turn of the 19th and 20th centuries and continue to indirectly inform contemporary urban green space design. It is also relevant to note that in the late 19th century, a primary objective of urban planning was the resolution of public health issues, which was addressed, amongst other things, through the creation of urban

parks. These green spaces were often designated on the sites of former marketplaces and fortifications, or within previously undeveloped areas. Consequently, such regulation is intrinsically linked to the configuration of the built environment and the transformation of the urban structure, which gave rise to new morphological regions—distinct types of urban tissues—interconnected with green areas. The historical and contemporary accessibility of these green spaces is further tied to these regulatory and morphological factors, highlighting the extent of their spatial integration.

Using Bratislava and Novi Sad as paradigmatic examples, we examine the trajectories of turn-of-the-century urban green space planning. These historical approaches significantly shaped the morphological patterns of the modern city.

3.1. Pressburg/Pozsony (Bratislava, Slovakia)

Unified city regulation in Pressburg/Pozsony (Bratislava nowadays) was preceded by the City Building Code (*Bauordnung*) of 1872. This code's first section outlined the general rules and responsibilities for construction. It covered new constructions, modifications to older buildings, and the establishment of new districts. In 1896, in parallel with the preparation of a new regulation and expansion plan for the city, a new building code was prepared. The new building code (*Gesetz-artikel 1896/XXIII*), comprising 454 paragraphs, was presented to the city council in March 1897 [24]. It covered a wide range of regulations, including the regulation of urban structure, such as building lines and new forms of development like houses with front gardens and detached villa homes. The plan for the regulation and expansion of the city was submitted to the authorities in December 1898 [25].

The early 20th-century urban regulation of Pressburg/Pozsony is discussed by Moravčíková, Lovra, and Pastoreková [26]. In 1906, Antal Palóczy was commissioned to review an urban regulation plan for the city prepared in that year [27]. The following year, Palóczy was officially assigned to create the new urban regulation plan [28]. The first urban regulation plans were completed in 1908. As an introduction to these plans, Palóczy presented them on 12 December 1908, in a lecture titled *On the Regulation of the Free Royal Town of Pozsony (Pozsony szabad királyi város szabályozásáról)* [29].

As an active urban planner, Palóczy prepared comprehensive regulation and expansion plans for only two cities: Újvidék (Novi Sad, RS) and Pozsony/Pressburg (Bratislava, SK). On 4 December 1909, he delivered a lecture on the city's regulation plan before the local section of the Hungarian Society of Engineers and Architects (*Magyar Mérnök-és Építész—Egylet*) [30]. The lecture was also published as a separate reprint in 1909 [28]. In January 1909, Ágost Helmár also gave a lecture on the past urban regulation plan and current urban plan and planning principles of the city development [29]. Helmár considered Camillo Sitte's urban planning principles¹ [31] to be modern and exemplary for the development of modern urban construction. The final version of Pozsony's urban regulation and expansion plan (Figure 2) was completed in 1917 [26]. The plan and the beginnings of the modern urban planning of Bratislava are explained and presented in [26].

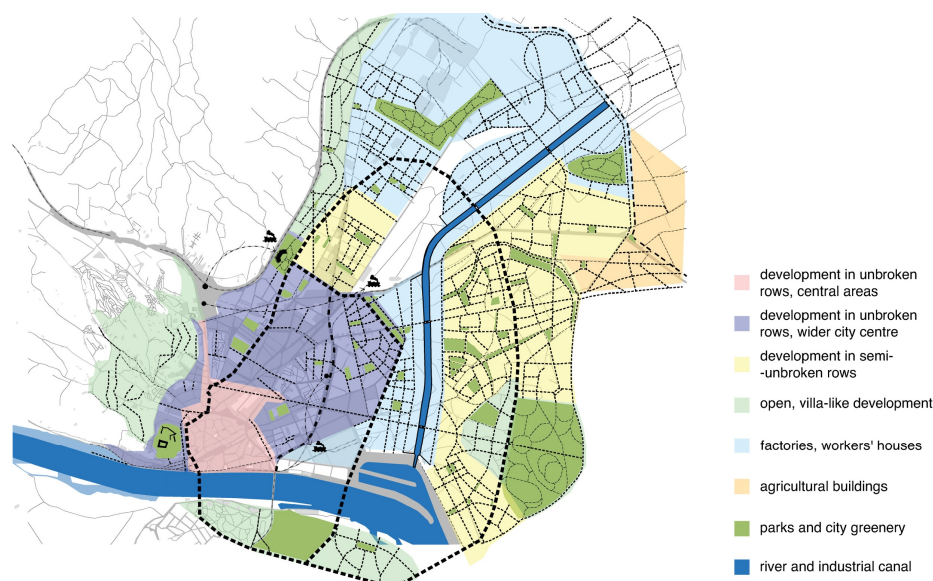


Figure 2. Reconstruction of the final version of Pozsony's urban regulation and expansion plan of 1917, based on the published plan [32] (p. 39) and the research by Henrieta Moravčíková, Éva Lovra and Laura Krišteková (neé Pastoreková) in 2017. Drawn by Krišteková in 2017 [26].

The 1906 plan followed the urban planning principles of Josef Stübben and Otto Wagner, which emphasised an orthogonal street structure, the formation of regular blocks, and boulevards, aiming to solve the problem of increasingly intense traffic. However, in Helmár's opinion, "Sitte demonstrated that these are not true urban spaces and are not even suitable for traffic purposes" [29] (p. 28). In contrast, "Pozsony is so fortunate that it entrusted the elaboration of its new expansion and regulation plan to Antal Palóczi, an architect and professor, who faithfully follows Sitte's principles, i.e., the latest and completely proven principles of urban planning [29] (p. 29). The presentation also revealed how Palóczi's plan differed from the concepts of Stübben and Wagner and how it adhered to the principles advocated by Sitte. Palóczi would consider it a mistake "if a standardized, indifferent division were to be created in the area designated for the city's growth, and if that ruler's grid, which, unfortunately, has already found some application, were to be attempted and established with the elimination of all artistic sense (. . .). Therefore, in the road network of the enlarged city, I strived to proceed in the spirit of my predecessors, encouraged by their example, and to assert these higher and artistic considerations in the design of the road network" [29] (pp. 9–10). The application of these principles primarily manifested in the alignment of new streets to the city's slopes, while also placing great emphasis on developing public health conditions: green areas separating industrial from residential areas, wider street widths, new squares and parks, and the opening of streets could have achieved the loosening of the dense urban fabric and the division of large blocks.

Although his comprehensive plan was never fully implemented, Antal Palóczi shaped modern urban planning in Bratislava. The town's developmental history has been profoundly influenced by numerous unrealised proposals, alongside those that came to realisation [33]. Some concepts from Palóczi's design, albeit in modified forms, were eventually realised, such as the line of the SNP Bridge and its associated road network. Furthermore, the city's outlying areas have been integrated into the urban fabric. The contemporary direction of Bratislava's development is also indirectly guided by its urban green spaces, which trace their origins to early 20th-century green area planning initiatives.

3.2. Újvidék (Novi Sad, Serbia)

Despite the progressive urbanisation initiated by the *Ausgleich* (1867), the continuous development of Novi Sad was not primarily associated with building regulations. Instead, the city's expansion was constrained by its natural environment, specifically the marshy areas alongside the Danube River, which prevented construction. However, this natural barrier did not hinder the city's growth towards the northwest and northeast.

The initial significant steps towards modern urban planning, regulation, and planned expansion in Novi Sad were undertaken by József Szauter, the chief city engineer. His decree [34], issued on 26 May 1897, outlined the necessary conditions for obtaining building permits. On 1 February 1900, the building regulations and architectural statute, titled *Bauordnung—Građevinski Štatut za slob. kr. varoš Novi Sad* [35], were adopted. This trilingual document (Hungarian, German, Serbian) precisely regulated construction activities and the work of relevant committees. A crucial aspect of urban regulation was the division of the city into zones (Chapter VI, §21). Different building densities and types were permitted in each of the three defined zones, influencing street alignment and the development of urban green spaces. Green spaces were not regulated separately but were addressed as an adjunct to the building methods applicable within each zone.

Engineer Gojko Damjanov's note [36] on the development of Novi Sad in 1908 emphasised that the city had developed very little since 1885, especially considering its favourable geographical conditions.

According to an announcement in the journal *Art (Művészet)* on 15 February 1908, the following architects received equal prizes in the urban planning competition to design the urban expansion plan of the city: Imre Francsek and Lipót Berceller, Antal Palóczy and György Kopeczek, and József Wälder [37]. The 1908 urban planning and expansion plan for Novi Sad [38] was based on a detailed base map published in 1900 [3] (pp. 145–174). Although the works submitted for the competition have not survived, solutions proposed in Antal Palóczy's plan can be observed in the official urban planning and expansion plan created in 1910/1911. The other author of the regulatory plan was László Szesztay, whose land survey² laid the actual groundwork for modern urban planning in Novi Sad. The initial sketch of the Palóczy-Szesztay plan (Figure 3) for Novi Sad aligned with the 1900 architectural regulations.

The plan proposed opening new streets, widening narrow streets, opening cul-de-sacs, and creating and afforesting squares and parks (gardens). Straightening irregular street axes was beneficial for paving and easing traffic flow, while street vegetation was intended to “decorate the city, and primarily clean and refresh the air, reduce heat, and provide shade” as the author (Cs. L.) states in the article from 1911 [39]. The primary guidelines for preparing the plan were “the creation of a modern urban development programme in accordance with aesthetic and health requirements” [39] (pp. 1–2), aiming to ensure the city's harmonious future development. The creation of parks and public spaces was also included in all three plans (1908, January 1911, and July 1911 descriptions). The achievement involved opening new spaces, utilising undeveloped urban areas, and expanding existing parks and gardens. The plan suggested using expropriation to open new spaces and parks, thereby loosening the network of dense blocks. The importance of these measures was justified as follows: “Park developments and afforestation are particularly urgent from a hygienic point of view, as these are the lungs of the city for the benefit of the inhabitants” [39] (pp. 1–2).



Figure 3. Map and urban development plan of the Free Royal Town of Újvidék (Novi Sad) by László Szesztay and Antal Palóczy. Categorical colour scheme: pink—development in unbroken rows, central areas; violet—development in unbroken rows, wider city centre; yellow—development in semi-unbroken rows; greenish-blue/blue—open, villa-like development; grey/light blue—factories, workers’ houses; greenish-yellow—agricultural buildings; green—parks and city greenery; blue line with blue shadow—river and industrial canal. Source: Budapesti Műszaki és Gazdaságtudományi Egyetem Urbanisztika Tanszék Térképtára 1910/1911.

While the Szesztay-Palóczy plan was never fully realised, its influence remained significant, persisting through evolving regulatory frameworks to shape the urban development of the city. This continuity is most evident in the 1929 plan [40], which adopted the 1912

block map and the 1910/1911 proposals as its technical foundation. The 1929 iteration reveals this through its direct use of the original line drawings, consistent structural modifications, and the specific depiction of consolidated blocks. Effectively, the August 1929 plan (Figure 4) functioned as a three-dimensional historical composite: it preserved the city's original street structure as a base layer, overlaid the Palóczy-Szesztay urban block system as a middle layer, and finally integrated the new visions of the 1929 creators as the defining top layer.

In 1937, Branko Maksimović addressed the crisis of modern urbanisation in his notes [41], to which he appended a plan that precisely followed the urban planning concepts and solutions of Palóczy and Szesztay. By 1939, urban planners responded to historical events by moderating their transformative ideas for the city [42].



Figure 4. Plan of the city of Novi Sad from 1929. Reproduced from Svirčević [43], courtesy of the Historical Archives of the City of Novi Sad. Categorical colour scheme: orange—built environment; green—urban green spaces and the Danube River; yellow—street network; red (dashed) line—planned urban blocks and street lines.

The General Urban Plan, which came into effect in 1950, proposed and implemented radical changes in the city [44]. The original railway line had been retained in its initial location even in the Szeszty-Palóczy urban expansion plan, but that plan did propose a new line near the industrial canal, laying the groundwork for a new industrial district. The 1950 plan, however, suggested relocating the city's entire railway line. The plan envisioned the new corridor in the northern part of the city, close to the industrial canal (nowadays only a road reminding us of the canal), with the intention of moving all urban industry to this new industrial zone. Additionally, the canal was to establish a new connection with the Danube to accommodate a new cargo port (a plan for which had already appeared in the 1910/1911 urban plan). The train station was moved to the northwest, effectively rerouting the railway to bypass the city (even though its northern side is now developed). By relocating the railway network, urban expansion shifted southward, towards the Danube. The 1950 plan also transitioned the city from its previously used radial road network to an orthogonal scheme. These changes, the relocation of the railway line and main routes, and alterations to the road network, fundamentally changed the direction of the town's development.

3.3. Urban Tissue Types Attached to the Urban Green Spaces

The urban fabrics and structures of cities from the Austro-Hungarian period were examined by using the integrated urban morphological method and the urban tissue catalogue as a result of the urban morphological characteristics.

According to the integrated urban morphology method and the resulting urban tissue type catalogue [2,45], the following type variations were found in the immediate vicinity of urban green spaces during the early period of modernisation: Types "I" and "J" are still present today in the inner core. This indicates that urban development only indirectly and partially transformed the fabric of the city's inner areas. This is characterised by infill development and the retention of the original plot system.

The morphological analysis of cities is both directly and indirectly linked to the investigation of urban green space integration. This study examined various urban tissue types, both with and without the consideration of integration levels, by primarily utilising historical records (specifically cadastral maps, which provided sufficient detail for the analysis). As the two parallel investigations yielded identical results, the characteristic urban tissue types can be linked to the inner fringes, intermediate fringes, or the green spaces other than those within the urban fringes. In the case of Bratislava, the site and its associated built environment situated on the former city walls remain clearly distinguishable. The definition of these urban fabrics was based on the built environment as it existed during the primary period of the green spaces' formation.

(Cb) Coherent public building complexes in the intermediate green fringe: This type describes a large, coherent plot typically containing multiple public buildings and often includes public gardens or smaller parks. The plot is usually bordered by streets unless otherwise indicated. The urban fabric here shares similarities with industrial areas and privileged public building zones, but the features, functions, and specific building layouts distinguish it. Examples include public buildings or army barracks. Towns: Novi Sad and Bratislava.

(Cd) Prestigious or recreational areas in the intermediate green fringe and connected to green spaces other than those within the urban fringes: This urban tissue type is characteristic of more prestigious or recreational areas. It features freestanding buildings, completely surrounded by gardens or parks, with secondary buildings discreetly placed. Detached villas and palaces are typically set back from the street line. The street network can be regular or adapted to the terrain's inclination. Town: Bratislava.

(Ia) Rectangular plots with semi-unbroken rows in the green spaces other than those within the urban fringes and inner fringes: This type consists of rectangular plots with regular geometry and development in semi-unbroken rows. Courtyards are located behind the buildings and connect either: (a) to a garden that extends to a lower-ranked street parallel to the main street, or (b) to a garden behind the courtyard. A separate residential plot faces the lower-ranked street. There are two plots in a line connecting the streets. The streets are regulated and orderly planned. The lower-ranked street can serve as a service road, as it is predominantly bordered by green space. Town: Bratislava.

(Ic) Gridiron system with mixed development (Figure 5) in the green spaces other than those within the urban fringes and inner fringes. This type features a gridiron street network (regular street network). Plots are typically regular and elongated rectangular. The urban tissue may include a public building (or buildings), characteristic of a wider central area. The block consists of detached houses mixed with unbroken rows. Buildings are placed on the street line, often as “L”-shaped buildings or those with left wings, and there’s a rare building line connecting detached houses and blocks. The built-up percentage is approximately 25% of the entire plot. Plot series are symmetrical on both axes. Town: Novi Sad.



Figure 5. Novi Sad, the former Kossuth Lajos Street viewed from the tower of the town hall, 1904. Source: Fortepan/Magyar Földrajzi Múzeum/Erdélyi Mór cége. Photo no. 86426.

(Id) Irregular rectangular shaped blocks with mixed use in the green spaces other than those within the urban fringes: This type has a regular street network, but the plot series or blocks have an irregular rectangular shape that follows the street lines. Plot shapes exhibit high variability, and traces of original (pre-regulation) plot shapes may remain. The urban tissue is mixed (residential and public), and blocks often feature secondary roads or pedestrian routes in their interiors. The interior of the blocks is coherent but in some cases separated by side wings or attached buildings. Most buildings lack wings, and development is in unbroken rows, though a rare building line is observed. Towns: Novi Sad, Bratislava.

(Ja) Irregular plots with complex row development in the green spaces other than those within the urban fringes: This type features plots with irregular geometry that form complex plot series. Development is in unbroken rows with variable building layouts, including “U,” “L,” and traditional rectangular shapes. Outbuildings (sometimes more than three) are attached to the main building. In all cases, a courtyard belongs to the buildings, surrounded by structures located on the same plot. The shape of the plots reflects pre-regulation land distribution, which has largely remained unchanged. As a result of street system regulations, the distribution of building layouts along streets has changed, while the traditional (pre-regulation) development method within the blocks has remained consistent. Towns: Novi Sad, Bratislava (regular network).

(Jb) Semi-regular network with enclosed courtyards in the inner fringe belts: The street network here is not entirely regular, partly adapted to the geomorphological characteristics (modest inclination) of the area. Plots have semi-regular geometry. Building facades are placed on the street edges, resulting in development in unbroken rows. Buildings can be “U,” “L,” “G,” or “O” shaped, and an inner courtyard is enclosed by them. Buildings form closed building blocks, but the courtyards do not form a coherent network. Towns: Novi Sad, Bratislava.

(Jc) Regular road lines with dominant winged buildings in the inner fringe belts: This type features regular road lines, with blocks surrounded by a gridiron street network. Blocks are rectangular, and buildings with both-side wings dominate within the plot series. Plots within an urban block have the same dimensions, but building placements vary. An inner courtyard is attached to each building, though in most cases, groups of backyards are separated by back or side wings. Triangular block shapes are also possible. Towns: Novi Sad, Bratislava.

(Jg) Semi-regular or regular geometry with unbroken rows (Figure 6) at the area of the former city walls (fortification): Streets and plots have semi-regular or regular geometry, forming complex plot series. Development is in unbroken rows with variable building layouts, including “U,” “L,” and “O” shapes. In all cases, a courtyard belongs to the building. As a result of street system regulations, the distribution of building layouts along streets has changed, while the traditional (pre-regulation) development method within the blocks has remained consistent. Towns: Novi Sad, Bratislava.

(Nc) Regular gridiron with detached buildings and rear building lines in the intermediate green fringe: This urban tissue is characterised by a regular gridiron street network enclosing regular blocks. Block shapes are elongated regular rectangles, separated into two parts (yard and garden). It features detached buildings with a rear building line. The district is not necessarily integrated with or directly adjacent to the town; it could be located as a workers’ estate, potentially even behind railway lines (this does not apply to cases where the urban neighbourhood is part of an urban agglomeration). Towns: Novi Sad, Bratislava.



Figure 6. Bratislava, the former Kossuth Lajos Square, 1912. Source: Fortepan/Fortepan. Photo no. 8925.

3.4. Integration of the Urban Green Spaces as Measurement of the Change

The inner and middle fringe period of Bratislava is related to a major pause in urban growth. These fringes represent the first green belt shaped by the presence of green spaces surrounding the city centre. In the 20th century, in the city plan, these green belts caused the formation of an outer fringe that fringes the city's historical urban area (inner and intermediate fringe) and surrounds the green space belt extending outward from today's city centre (outer fringe). This outer fringe shows clear differences from the physical characteristics of the inner and intermediate fringes in terms of the layout of building blocks and street patterns. Although this fringe has been shaped mostly by green spaces associated with the patterns of more regularly planned streets and building blocks, and the natural landscape patterns designated for these parcels, the boundaries—as in almost every major city—are defined by connections at the regional level via major roads or at the neighbourhood level via streets.

Due to the nature of the city plan, many interconnected origin pairs and destinations develop along the periphery of the outer fringe, forming routes that connect all other parts of the city through the settlement areas of the inner and outer fringes. In this context, the degree to which urban green spaces are connected to these routes—at the neighbourhood and local level—plays an important role in explaining the direction of urban development and the transformation of the city.

Differences within the syntax structure of the streets and the way they are connected to each other reveal the configurational structure of the built form. For that matter, applied space syntax analysis reveals different intersection angles and different intersection degrees and types, due to differences in the fringe periods. Therefore, urban green spaces in different fringes contain different configurational properties according to the intersections.

Even though the graphical representation of the integration provides a profile of many attitudes and the hierarchy of relationships between regions, quantitative attributes can only provide insights into the role of urban green spaces in the direction of development.

We used the boxplot statistical analysis method to illustrate the complementary outputs of the space syntax map. The output map of Bratislava (Figure 7) shows that urban green spaces in the ancient fortification have very high median integration values, reflecting that these green spaces are the most integrated at the 20th century. However, their mean and median integration values have substantially declined in the current state, which indicates that they have lost historical spatial centrality and significance. These results highlight that the type of these green spaces is not stable in the urban fabric of the most preserved areas, indicating that planning decisions for green spaces have not been significantly considered in the integration of the urban structure.

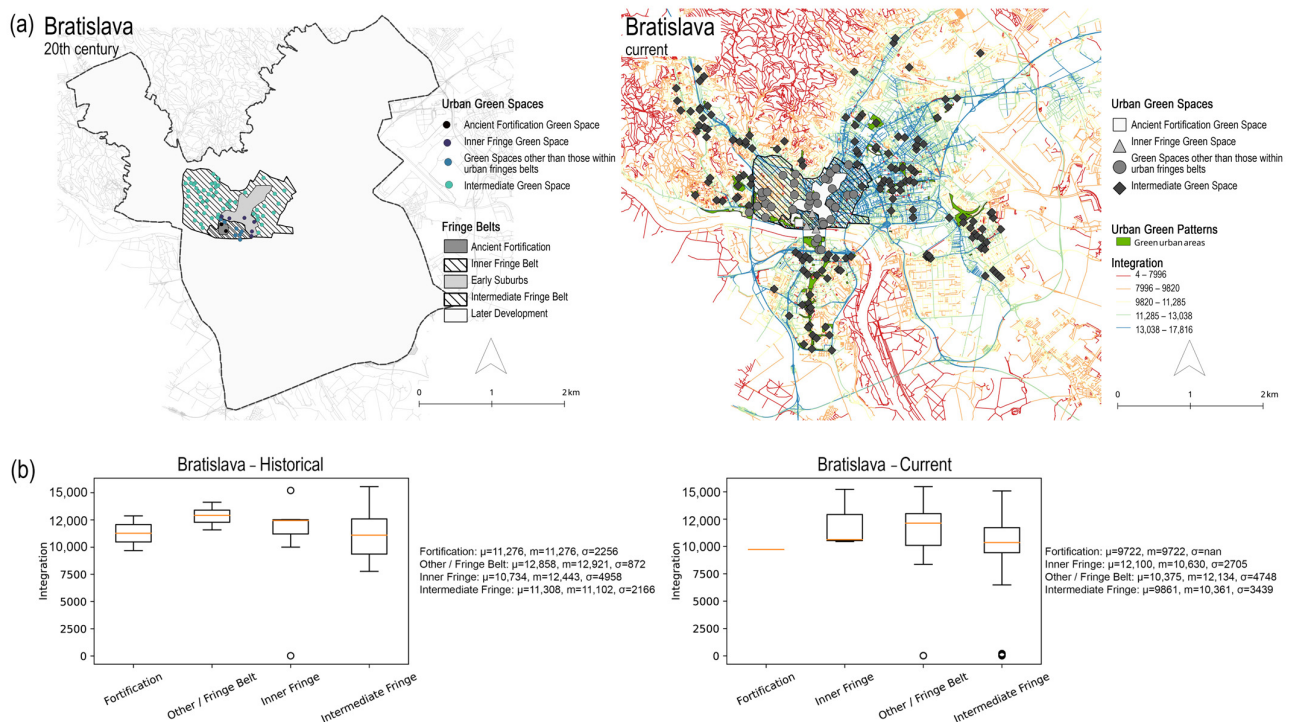


Figure 7. Spatial distribution (a) and statistical distribution (b) of urban green spaces and their fringe belt formation for the map period of 20th century and current period in Bratislava. Nan indicates that the value could not be computed. Source: Authors, 2026.

Inner fringe green spaces historically have high median values with very wide integration values, suggesting heterogeneity in spatial accessibility. In the current phase, they are losing their median integration role and have a narrower distribution, which indicates that they have altered from structural connectors to more localized green spaces and shifted as transitional green spaces between the ancient fortification and later alteration of the city. However, they still remain an ecological contribution to the city, although in very different direction.

Green spaces located other than those within the urban fringe belt have historically the highest mean and median integration values, which suggests strong integration variations with higher values. Although their influential role in historical integration is prominent, in current state they show a greater predominance of lower integration values that affect the reduction in upper integration values. These results highlight that their structural dominance is fragmented and that they have lost their significance, with relatively reduced stability during the formation of the current urban fabric.

Green spaces in the intermediate fringe belt show moderate median integration historically, which reflects their functions as elements of urban expansion. In the current phase, there appear low integration outliers and increased dispersion between the values. These results reflect that peripheral expansion has resulted in these green spaces primarily serving for local users and being likely low integrated within the entire spatial integration.

In the case of Novi Sad, the major factor in the formation of the inner fringe belt is the resilience of the land use type and the fluctuation of urbanisation over time. This is particularly related to the resilience of the built-up area. In the case of land use types, green spaces are a significant component that marks the limits of urban growth during the inner fringe belt period. When the urbanization period pursued its outward spread from the inner fringe belt, associated with the new routes, it resulted in the limits of the next phase of development (intermediate fringe), generally shaped by a new planning perspective. The outcome in the landscape of the intermediate fringe belt is often characterised by land uses that include more regularly planned green spaces deeply integrated within the urban fabric. However, in the case of Novi Sad, this is more about survival with significant planning implementations.

Analysis shows that in Novi Sad (Figure 8), there appears to be a relationship between the distribution of green spaces and the integration levels with modern urban planning principles. While, the inner fringe green spaces had the highest median integration and the highest variation in integration in the 20th century, they have substantially lost their integration role and their variability in current phases. These results reveal fragmentation of green spaces within this fringe belt formation, but they still preserve their functionality, possibly due to remnants of earlier urbanisation acts, which partially resulted in discontinuous green corridors and the planning resilience of green spaces in the historic urban fabric.

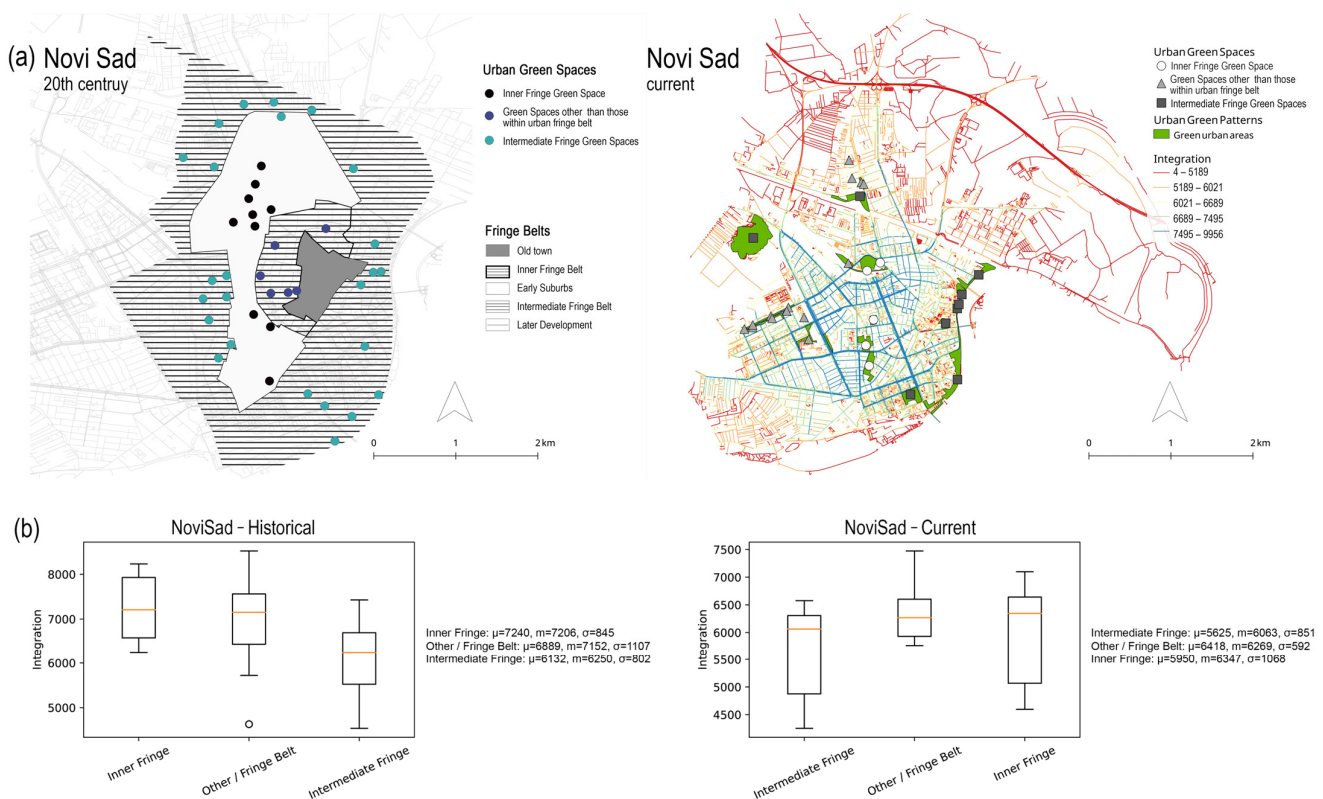


Figure 8. Spatial distribution (a) and statical distribution (b) of urban green spaces and their fringe belt formation for the map period of 20th century and current period in Novi Sad. Source: Authors, 2026.

Nevertheless, the results also reveal that green spaces other than those within the urban fringe belts exhibited the highest mean and median integration values historically. These green spaces are spatially embedded into transition areas in their current state, which is depicted in the reduction of both their median and mean integration values, and an increasing in clustering around the lower integration values. The results highlight that integration is varying in resolution, which suggests fragmentation toward more suburban development. On the other hand, the urban green spaces in the intermediate fringe belt show the lowest mean and median values in the current state, reflecting greater fragmentation. The results reveal that spatial disconnect in green spaces is more apparent. This can be attributed to less connected green spaces and low functional integration in the expansion areas, which are influenced by urban planning intervention and significant changes in the direction of development.

3.5. Comprehensive Cross-Analysis: Urban Regulations/Development, Urban Morphology and Space Syntax

A comprehensive cross-analysis (Table 1) has identified configurational distinctions among fringe belts, as it is already indicated in the urban tissue definitions. Inner fringe belts, such as (Jg), which are linked to former city walls (fortification) or the inner urban nucleus, demonstrate the highest median integration values in both Bratislava and Novi Sad. This underscores their significance as central historical cores. Conversely, green spaces within intermediate urban fringe, exemplified by (Nc), exhibit lower mean and median integration values in their present condition. This decline signifies an increased level of spatial fragmentation and a functional disconnection from the urban core.

Table 1. Comprehensive cross-analysis. Source: Authors, 2026.

Urban Fringe Category	Representative Urban Tissue Types	Historical Integration (20th Century)	Current Integration (21st Century)	Spatial Characteristics
Inner (urban nucleus, city wall zone)	(Jg) Semi-regular/regular geometry with unbroken rows.	Highest median values; functioned as primary structural.	Loss of historical spatial centrality.	Transitioned from central urban anchors to localised green patches.
Inner (non-fortified)	(Jb) Semi-regular network; (Jc) Regular lines with winged buildings.	High median values with wide distribution (heterogeneity).	Lower median and narrower distribution.	Shifted from structural connectors to transitional spaces.
Intermediate	(Cb) Coherent public complexes; (Nc) Regular grid with detached buildings.	Moderate median integration; functioned as expansion elements.	Lowest mean/median values; emergence of low-integration outliers.	High fragmentation; primarily serves local users with low global accessibility.
Other green spaces (non-fringe)	(Ia) Semi-unbroken rows; (Ic) Gridiron mixed development.	Highest mean and median values historically.	Predominance of lower values; clustering around low integration.	Fragmented structural dominance; loss of significance in the current fabric.

The integration of planning history into the morphological analysis demonstrates how specific regulatory and planning decisions directly impacted measurable spatial integration:

The 1950 Novi Sad General Urban Plan implemented a radical re-routing of the entire railway network to the north and shifted the urban development of the city from a radial road network to an orthogonal scheme. Space syntax analysis confirms this resulted in a shift in development southward, which lowered the global integration of historical green zones that were once at the edge of the former rail line, also leading to lower integration values in the newly developed green zones compared to the historical core.

Palóczy's Sitte-Inspired Planning (Bratislava): Antal Palóczy followed Camillo Sitte's principles in his urban plan for Bratislava, principles which prioritized artistic street alignment over rigid gridirons to preserve urban character. The measurable resilience of certain inner fringe integration values in Bratislava is attributed to the partial realisation of these principles. The alignment of the SNP Bridge road network, already envisioned by Palóczy, but without the demolition of the surrounding area, maintained connectivity for adjacent green areas despite later modernisations.

The trilingual 1900 building code in Novi Sad divided the city into three zones with distinct permitted building densities. This decision directly influenced street alignment and the subsequent embeddedness of green spaces. Areas with lower density zones correlate today with the lower integration values found in the intermediate fringe belts.

4. Conclusions

This study's integrated analysis of urban morphology and space syntax reveals the evolution of green space systems within four cities formerly part of the Habsburg Central Europe. The findings demonstrate that the development of urban green spaces resulted from a dynamic interplay among overlapping planning approaches, local contexts, and the historical urban fabric. The Austro-Hungarian Compromise of 1867 served as a catalyst for an era of modernisation where the creation of parks and green avenues became synonymous with national representation, public health, and a modern urban identity.

The study demonstrates that the evolution of urban green space systems in Bratislava and Novi Sad is a product of complex historical planning layers, local geographical constraints, and the enduring influence of the 1867 Austro-Hungarian Compromise. By applying an integrated methodology—combining fringe-belt theory with space syntax—the research moves beyond a descriptive historical account to provide a quantified structural interpretation of how green spaces are embedded within the urban fabric.

The concept of urban green spaces as discontinuous fringe belts is essential to understanding their historical formation and spatial embeddedness. Applying Jeremy Whitehand's fringe belt concept and quantifying it through space syntax proved effective in categorising and analysing the spatial characteristics of green areas. Distinct integration patterns were observed across the inner, intermediate, and outer fringe belts in Bratislava and Novi Sad. Although Novi Sad's development was significantly shaped by the radical re-routing of its railway and the shift to an orthogonal grid in the 1950s, which fundamentally altered the development trajectory envisioned by Palóczy and Szesztay and impacted the connectivity of its green spaces.

The findings consistently show that green spaces located within the inner fringe belts exhibit the highest levels of spatial integration. These quantitative insights, complemented by qualitative historical and morphological analysis, offer a comprehensive understanding of how urban green spaces contribute to the overall spatial hierarchy of Central European cities. While these patterns offer a framework for understanding regional urban evolution, the strength of these claims is grounded in the specific trajectories of Bratislava and Novi Sad and should be interpreted within that context. In Bratislava and Novi Sad, these inner-belt green spaces remain the most accessible and connected parts of the urban green network. In contrast, green spaces in the intermediate and outer fringe belts display greater heterogeneity and generally lower integration values. The intermediate belts, often developed during periods of rapid and sometimes fragmented expansion, show a mix of well-integrated parks and isolated green spaces. This quantifiable distinction among the fringe belts provides a clear narrative of urban evolution.

The primary contribution of this integrated approach lies in its ability to validate morphological regions as distinct functional zones within the city's accessibility hierarchy.

The morphological analysis identifies specific urban tissue types—such as the coherent public building complexes (Cb) or semi-regular geometries (Jg) found at the sites of former fortifications—that characterise the inner and intermediate fringe belts. Space syntax integration values provide the empirical basis for these findings, revealing that these historical tissues are not just artifacts but retain high levels of structural connectivity and accessibility within the contemporary city.

The results from the two case studies show a consistent correlation between morphological fringe periods and spatial integration:

In both cities, the inner fringe belts—representing the first green spaces established after the removal of historical limitations like city walls—exhibit the highest levels of spatial integration. In Bratislava, these spaces show a mean integration value suggesting they remain the most accessible and connected parts of the urban green network.

In contrast, green spaces in the intermediate and outer belts display significantly greater heterogeneity and generally lower integration values. This suggests that while inner-city green spaces are deeply embedded in the historical urban skeleton, newer expansions often suffer from greater spatial fragmentation, potentially due to the transition toward more autonomous, open-row planning or radical infrastructural shifts, such as the 1950s railway re-routing in Novi Sad.

While these findings suggest that the foundational green networks of the Austro-Hungarian era continue to correlate with contemporary urban structures, the scope of this study remains limited to the specific historical and geographical context of former Habsburg Central Europe. The strength of these claims is therefore grounded in the specific trajectories of Bratislava and Novi Sad, where the preservation of historical tissue types (I and J) in the inner core has maintained high functional connectivity. Future research should apply this integrated methodology to a broader range of cities to determine if these patterns of fringe-belt integration are universal to the region or specific to the urban regulation principles advocated by figures like Antal Palóczi. Ultimately, this research provides a nuanced framework for urban planners to understand the long-term structural associations of green space distribution on urban continuity and accessibility.

The study moves beyond a purely descriptive history or a static spatial analysis to show how urban form is a dynamic process. The quantitative data derived from space syntax gives empirical weight to the qualitative insights of urban morphology, allowing for a detailed mapping of how green spaces are embedded within the urban fabric. This shows that historical green spaces are not isolated artifacts but are structural elements that contribute to the coherence of a city. Future research applying this integrated approach to a broader range of Central European cities, or comparing these findings with cities in other historical contexts, could further refine the theoretical understanding of urban green space evolution. Despite significant political and socio-economic changes throughout the 20th and 21st centuries, the foundational green networks established during the Austro-Hungarian era continue to correlate with the accessibility and spatial configuration of green spaces today, within the analysed Central European contexts.

The results presented here highlight important correlations between historical green space planning and contemporary urban accessibility. Nevertheless, due to the comparative case design employed, additional research is required to determine if these associations continue across a broader diversity of Central European urban contexts beyond the specific historical and legal frameworks analysed in this study.

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visualization, E.S.; supervision, É.L.; project administration, É.L.; funding acquisition, É.L. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement: All components of the work rely on open-source software, and datasets used in this study are derived from publicly available sources. The resulting scripts and full analytical workflow, with the specification of reproducibility, will be available in the forthcoming work (Space Syntax and Urban Morphology in Historical Context: Mapping Green Space Systems). Due to licensing restrictions and data size limitations, the original datasets are not redistributed.

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Notes

- ¹ Camillo Sitte argued that modern engineering prioritised traffic and hygiene over aesthetics, proposing a city design with interconnected spaces. His principle was spatial enclosure, achieved through strategically placed buildings and street apertures. Sitte favoured street entries where streets intersect plazas at angles to block long vistas and maintain containment. He rejected rigid symmetry and straight lines, believing irregularity, like non-parallel walls and curved streetscapes, created a more organic and visually engaging environment. Sitte believed major civic buildings should be integrated into the urban fabric, functioning as part of a cohesive spatial enclosure.
- ² The map of Újvidék (Novi Sad), a free royal town, and its urban development plan are held at the Central Statistical Office (KSH) Library under the call number TF 0004. While the document lists Antal Palóczy and László Szesztay as its authors, research suggests that the 1910/1911 map (KSH TF 0004) serves as a basis for the larger development plan. László Szesztay is the sole author of the printed base map, which represents the precise survey of the city. The unmarked map found at the Urbanism Department Map Collection has the same base as the 1910/1911 Map of Újvidék and Urban Development Plan, but the colouring, regulatory lines, new roads, blocks, and expansion are attributed to Palóczy and Szesztay's collaborative work. See more in [3].

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