AMIR SIRJANI

ASSESSING URBAN WALKABILITY

A SPACE SYNTAX EVALUATION OF PUBLIC SPACE DESIGN

DLA Dissertation

Supervisor: Szabó Árpád DLA

Budapest University of Technology and Economics
Doctoral School of Architecture, 2024

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ABSTRACT

This dissertation analyzes the influence of spatial configuration on the functionality and user engagement within urban public spaces, with a focus on Városháza Park in Budapest. By employing space syntax analysis alongside behavioral mapping, the research delves into how the physical layout of public spaces shapes pedestrian movement, social interactions, and overall user experience, offering a comprehensive evaluation of the relationship between spatial design and urban life.

A significant component of the study is the examination of design proposals submitted during a 2021 architectural competition for Városháza Park. The winning designs were selected for their innovative approaches and for their potential to meet contemporary urban design goals. The dissertation explores the critical step between design and implementation, providing insights into how conceptual designs are transformed into practical urban spaces.

Through a detailed analysis of the first and second prize-winning designs, the study reveals how different spatial configurations influence the usability and attractiveness of public spaces. It demonstrates how well-integrated and visually accessible areas promote pedestrian activity, while strategically segregated zones offer spaces for tranquility and specialized use. The research highlights the importance of a balanced design that caters to diverse user needs.

This dissertation contributes to urban design and planning by offering a nuanced understanding of how spatial arrangements can enhance or hinder public space functionality. It provides practical recommendations for designing urban environments that are both functional and engaging, as well as responsive to the needs of their users.

1. INTRODUCTION

In recent years, there has been growing interest in improving urban environments to make them healthier, more sustainable, and better suited for community life. One of the key factors in achieving this is walkability, which plays an important role in encouraging people to lead active lifestyles, reducing environmental impacts, and promoting social interactions. Walking has been the subject of increased attention as a critical factor in promoting healthier, more environmentally friendly, and socially active communities. Researchers in various scientific fields, including architecture, urban planning, and transportation, have been developing reliable tools to objectively measure the walkability of streets, neighborhoods, and cities.

Walkability can then be defined as "*how inviting a specific place is for pedestrians*" (Forsyth, 2015). Walking has been reduced to use as a general type of travel mode for different purposes, such as day-to-day traveling or leisure. Moreover, the expansion of cities and growing urban sprawl led to increased vehicle use, which in turn heightens car dependency and vehicle transportation, ultimately degrading space. The examination of the built environment for the appropriateness and attractiveness of walking has been significant for many decades in various scientific fields such as urban planning.

Most studies have recently measured walkability based on various environmental factors, such as the design and functionality of urban elements. However, only a few studies have linked walkability to the spatial configuration of the neighborhood, by measuring how the arrangement of surrounding spaces influences the movement of people. The purpose of this study is to explore the vision-based approach as a walkability index, examining walkability in terms of urban design using visibility and spatial configuration, and comparing it with actual behavior.

1.1. BACKGROUND

The study of public space and its impact on people has been a well-established field since the 1960s (Gehl, 2010). Urbanization, with its profound effects on streets and parks, became a central topic in urban studies, yet many developments during this period overlooked the human experience, focusing instead on efficiency-driven factors like cars, roads, factories, and large housing complexes (Project for Public Spaces,Inc., 2012). This oversight highlighted the need for a new approach aimed at creating cities that are "*fit for people*" (Gehl, 2010). As a result, various methods were developed to measure how urban spaces affect their inhabitants, particularly through their spatial configurations.

Walking, as the most fundamental mode of movement, is essential for both individual mobility and urban dynamics. It offers numerous benefits, including improved public health, enhanced social equity, and reduced greenhouse gas emissions (Gehl, 2010). However, the expansion of cities and the resulting urban sprawl have led to increased reliance on vehicles, further heightening car dependency and degrading urban spaces. These trends present significant challenges for urban planners, who recognize walking as a critical factor in reducing vehicle travel, curbing urban sprawl, and lowering emissions (Forsyth, 2015). By prioritizing pedestrian movement in urban design, cities can become more sustainable and livable.

Public health researchers also emphasize the importance of walking in improving health outcomes. Regular physical activity, such as walking, is linked to lower risks of chronic diseases, better mental health, and increased life expectancy (Sallis, et al., 2016). Therefore, integrating walkability into urban design is not only an environmental necessity but also a public health imperative.

Despite the growing emphasis on creating walkable public spaces, a significant gap remains in effectively integrating these considerations into urban planning. Traditional evaluation methods often prioritize environmental factors like physical design while neglecting how spatial configurations influence movement patterns and social interactions. This research seeks to address this gap by evaluating public space designs through a combined application of space syntax analysis and observational methods inspired by Jan Gehl. This integrated approach offers a more comprehensive understanding of how public spaces function and how they can be optimized to support walking and public engagement, ultimately contributing to the creation of urban environments that are truly fit for people.

1.2. OBJECTIVES

The primary objective of this study is to evaluate and enhance the effectiveness of public space designs in promoting walkability and public life through an integrated methodological approach. Specifically, the study aims to:

1. Analyze existing public space designs using space syntax to assess their spatial configurations and their impact on pedestrian movement and social interactions.
2. Evaluate actual pedestrian behavior within these spaces through Jan Gehl's observational methods, providing qualitative insights into urban engagement.
3. Integrate findings from space syntax analysis and behavioral mapping to identify strengths and weaknesses in current urban design practices, and to develop practical recommendations for improvement.
4. Demonstrate the value of combining quantitative and qualitative evaluation methods, contributing to a more comprehensive and efficient planning process for public space projects.

By understanding the potentials and limitations of space syntax and observational methods, urban planners can create public spaces that are both aesthetically pleasing and functional, conducive to public life. This aligns with the broader objective of creating 'Cities fit for people', ensuring that urban spaces are designed with the needs and behaviors of their inhabitants in mind.

1.3. RESEARCH QUESTIONS

Creating urban environments that are functional and enhance the quality of public life requires a deep understanding of how spatial design influences interactions within public spaces. This study examines how spatial layouts, as analyzed through space syntax, correlate with the actual patterns of movement and behavior observed in these spaces.

The study aims to answer the following research questions:

1. What is the potential impact of an additional evaluation stage between design and implementation on the effectiveness of public space designs?
2. In what ways do spatial configurations, correlate with observed pedestrian behaviors and usage patterns?
3. What specific recommendations can be derived from the integrated analysis to improve the design and planning of public spaces to better support walkability and public life?

By exploring these questions, the research aims to provide valuable insights and practical guidance for creating urban environments that prioritize human experience and foster vibrant, sustainable public life.

1.4. SIGNIFICANCE OF THE STUDY

This research addresses a key gap in urban design methodologies by combining quantitative and qualitative approaches to evaluate and improve public spaces. Integrating space syntax analysis with behavior mapping provides a comprehensive understanding of how spatial configurations influence human behavior, enhancing walkability and public engagement.

A significant focus of this study is the critical stage between design and implementation. By examining how design concepts are translated into practical urban spaces, the research emphasizes the need to ensure that designs are both feasible and responsive to real-world needs before full implementation.

The findings offer practical strategies for creating pedestrian-friendly and socially vibrant environments, contributing to more sustainable and livable cities. Additionally, by refining methods like space syntax and Gehl's observational techniques, the study advances urban design tools and supports better decision-making during the crucial transition from design to implementation.

Finally, this research aligns with the goal of creating "*cities fit for people*" (Gehl, 2010), prioritizing human experience, social interaction, and community well-being, and supporting global efforts toward more equitable and resilient urban environments.

1.5. METHODOLOGY OVERVIEW

The research adopts a mixed-methods approach, combining space syntax analysis and behavior mapping to evaluate public space designs. Space syntax, developed by Bill Hillier and Julienne Hanson, provides a quantitative framework for analyzing spatial configurations and their impact on movement patterns. Behavior mapping, inspired by Jan Gehl's observational methods, offers qualitative insights into how people use and experience these spaces.

This section outlines the methodological approach and research framework employed to evaluate existing public space designs using a combination of qualitative and quantitative methods. The objective is to develop a comprehensive understanding of existing conditions, identify areas for improvement, and verify the effectiveness of current designs based on their alignment with recognized principles.

The methodology is structured around the following key stages:

1. **Analysis of Existing Public Space Design**: The initial stage involves a detailed examination of existing public spaces using behavior mapping techniques. This qualitative method captures user behavior patterns and spatial usage, providing insights into how the space functions in its current state.
2. **Space Syntax Analysis**: This stage employs various Space Syntax techniques, including Visibility analysis, Axial Line analysis, and Isovist analysis, to quantitatively assess the spatial configuration of the public space. These analyses help to understand the visual connectivity, movement potential, and spatial integration within the space.
3. **Overlapping Behavior Map and Visual Integration Map**: By overlaying behavior mapping data with visual integration maps derived from Space Syntax, the study identifies correlations between user behavior and spatial configuration. This integrated analysis evaluates the effectiveness of existing public space designs.
4. **Evaluation Against Design Guidelines**: The final stage involves evaluating the existing designs against established urban design guidelines, particularly those inspired by Jan Gehl's principles. This step ensures that the spaces function effectively while also aligning with best practices in urban design.

Thesis 1 - Enhancing Walkability Through Strategic Urban Design

Introducing a systematic focus on walkability in the design of public spaces is essential for creating urban environments that are functional, promote social interaction, and support sustainability. Prioritizing walkability from the early stages of design ensures that urban spaces like parks, plazas, and streets are accessible and inviting for pedestrians, thereby reducing car dependency and encouraging healthier, more connected communities.

Emphasizing walkability in public space design addresses a critical need in urban planning, as it directly influences how people use and interact with these environments. By integrating walkability considerations into the design process, urban planners can create spaces that enhance the quality of life in cities. This strategy leads to the development of more sustainable and livable urban areas, where public spaces contribute positively to social, cultural, and environmental outcomes.

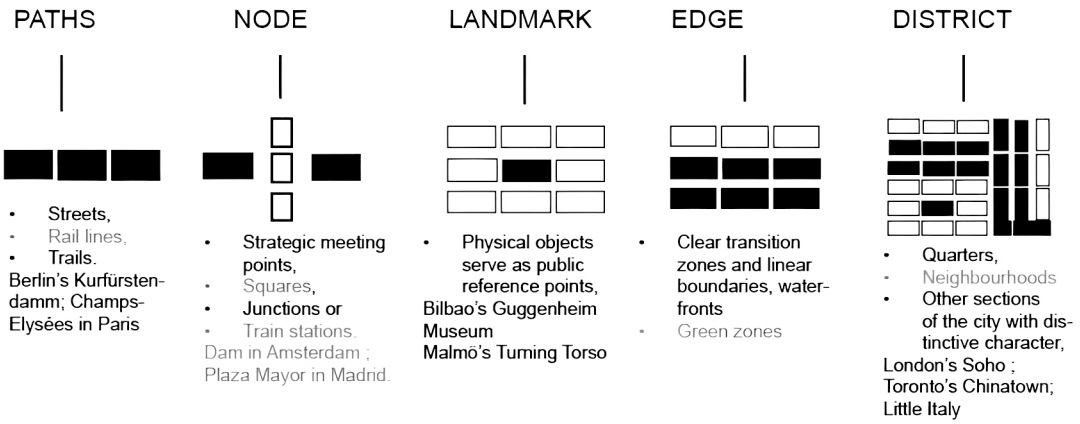
2. LITERATURE REVIEW

2.1. PUBLIC SPACE DESIGN: CONCEPTS AND THEORIES

Public space design is a multifaceted discipline that encompasses various theories and principles aimed at creating environments that are accessible, functional, and conducive to public life. The study of public spaces has evolved significantly over the past few decades, with an increasing emphasis on human-centered design. This shift is rooted in the recognition that public spaces are not just physical areas but are also social, cultural, and psychological environments that play a crucial role in urban life.

2.1.1. Kevin Lynch's mental mapping

Kevin Lynch introduced the concept of "mental maps" in his influential work 'The Image of the City' published in 1960. This book was the result of a five-year study of Boston, Jersey City, and Los Angeles on how observers perceive the city and use this perception to create mental maps (Lynch, 1960). Lynch proposed that these mental maps consist of five basic elements [Figure 1]:



[1] Kevin Lynch diagram of the "Five Physical Elements". (Source: Sonia Jojic, 2018, p156)

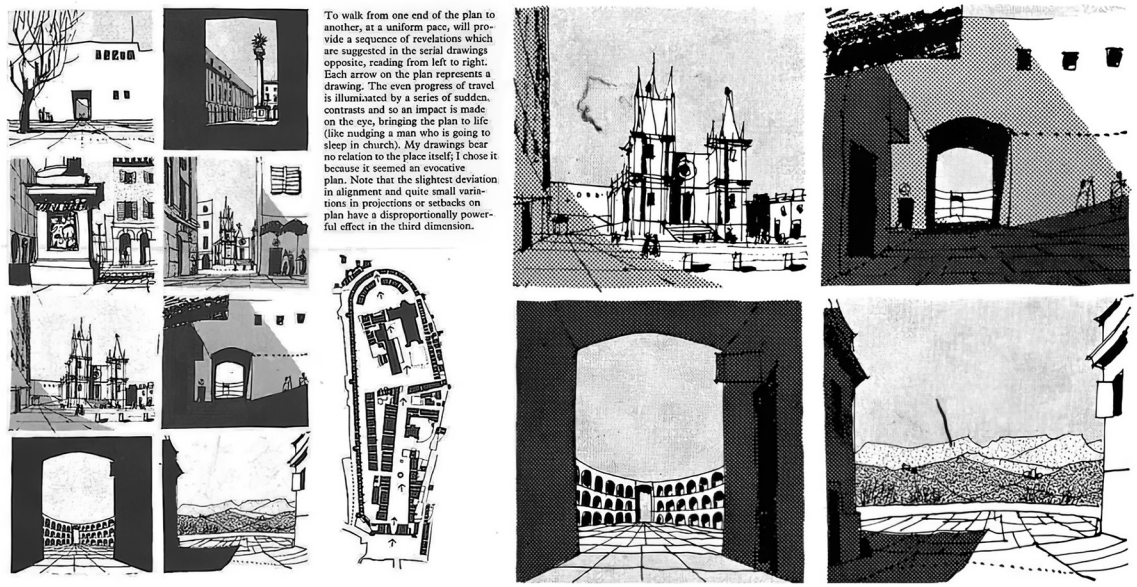
- **Paths**: These are the routes people travel by, such as streets, sidewalks, trails, canals, railroads, etc. They organize space and guide movement between spaces.
- **Edges**: These are perceived or real boundaries like walls, buildings, shorelines, streets, overpasses, etc. They define the limits and separate different areas.
- **Districts**: These are medium to large areas that one can enter into or out of. They have common identifying characteristics.
- **Nodes**: These are strategic points or areas that one can enter into. They serve as the focal points of the city, neighborhood, district, etc., offering multiple perspectives of the other core elements.
- **Landmarks**: These are reference points that a person cannot enter into. They include buildings, signs, stores, mountains, public art, etc., and have at least one unique or memorable aspect in the context they exist.

These elements need to form a coherent pattern to be "legible" for people using the space. Legibility refers to the ease with which people can understand and navigate a place. The more legible a city is, the easier it is for people to form mental maps and orient themselves within it. Lynch's work emphasizes that people's understanding of their surroundings is not just about physical locations but also about their relationships with these spaces. This relationship is created because of people's dependence on their surroundings to orient themselves (Lynch, 1960).

Lynch's methodology is particularly relevant to walkability, as it emphasizes the importance of spatial organization and how people perceive urban environments. Understanding how individuals mentally map their surroundings reveals insights into designing cities that are more navigable and inviting for pedestrians. By analyzing elements such as paths, edges, districts, nodes, and landmarks, it is possible to identify areas that may hinder or enhance pedestrian movement, ultimately contributing to environments that support and encourage walking.

2.1.2. Gordon Cullen's serial vision

Gordon Cullen, a British architect and urban designer, first introduced the term "serial vision" in his seminal work 'Townscape', a shorter version of which was later published as 'The Concise Townscape' in 1961. The concept of serial vision refers to the changing perspectives and sequential views experienced as one moves through space [Figure 2]. It's often explained as the unfolding visual experience - the way our perception alters and morphs as we journey across a landscape (Black & Phillips, 2020).



[2] Serial vision: Gordon Cullen drawings (published within Concise Townscape, 1961, p17)

Cullen emphasized that serial vision was more than just a visual experience; it encompassed the emotional and psychological journey undertaken when moving through space. He focused on the relationship between the places and things that one might encounter along the way (trees, built forms, traffic, and so on). He believed this sequence of visual events could be woven into a rich narrative, evoking powerful emotional responses (Black & Phillips, 2020).

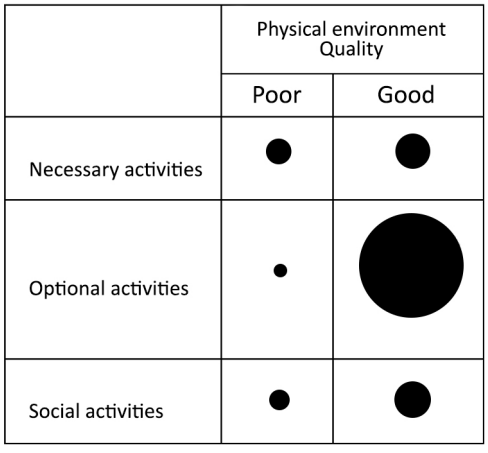
In his book, Cullen proposed three "gateways" to understanding our surroundings: Motion (Serial Vision), Position (Here and There), and Content (This and That). These gateways highlight the contrasts between different elements in our environment. For instance, you cannot have a 'here' without a 'there', or a 'this' without a 'that'. This idea emphasizes the importance of contrasts in our perception of space. Cullen's drawings within his book depict the imagined view from locations marked upon the accompanying floor plan, showing the dramatic contrast of heavy forms with enclosed and open spaces. These drawings serve to illustrate how people relate to their surroundings by noticing these contrasts. It emphasizes the importance of the changing perspectives we experience as we move through space, and how these perspectives can evoke emotional responses (Cullen, 1961).

2.1.3. Jan Gehl's method of observation

Jan Gehl has been a transformative figure in urban planning since the 1960s. His work has been instrumental in reshaping the way we perceive and design our cities, with a particular emphasis on enhancing the quality of urban life. His people-centric approach has significantly influenced contemporary urban planning and reshaped some cities into more vibrant and inclusive environments Gehl's approach to urban planning is people-centric, focusing on the form and use of public spaces. Despite various challenges, his methods have proven adaptable and effective across different locations and climates. As we continue to develop our cities, Gehl's philosophy serves as a valuable guide for creating urban spaces that truly cater to the needs of their inhabitants (Wheeler & Beatley, 2004).

Jan Gehl's method is based on his research in Copenhagen, presented in his 1971 book 'Life Between Buildings', which considered the importance of people in cities. Jan Gehl argues that successful urban design ensures a harmonious interaction between public space and public life. The constant change in life, which is often ignored, makes it difficult to forecast the behavior of an urban space; however, Jan Gehl proposes systematic measurements to analyze change over time. "*Anyone who decides to observe life in the city will quickly realize that you have to be systematic in order to get useful knowledge from the complex fusion of life in public spaces*" (Gehl & Svarre, 2013).

In 'Life Between Buildings', Gehl introduced his definitions of outdoor activities and how the quality of public space affects them [Figure 3].



[3] Graphic representation of the relationship between the quality of outdoor spaces and the rate of occurrence of outdoor activities. (Source: Gehl, 2011, p13)

He categorizes these activities into three types:

- **Necessary activities** - are more or less mandatory, include: going to school/work/home and waiting for the bus/green light. Therefore, the quality of the space has little impact on the activity.
- **Optional activities** - unlike necessary activities, are only carried out when wanted and consist of going out for food, strolling and watching people. Despite their non-mandatory nature, they require an optimal (inviting) spatial environment in order to succeed.
- **Social activities** - depend on the presence of other people. Therefore, they occur only when people are moving in the same space at the same time, includes: watching, listening, or conversing with other people. For the benefit of other people, there needs to be a good amount of both necessary and optional activities, in other words, good quality space.

Gehl's philosophy is rooted in the belief that it is possible to influence how people use public spaces. He emphasizes the importance of considering the number of people, the types of activities they engage in, and the duration of their engagement. This approach has led to the creation of vibrant, inclusive urban environments that encourage social interaction (Wheeler & Beatley, 2004).

One of his significant contributions to urban planning is his concept of "public life". He advocates for the importance of outdoor activities and social interactions in public spaces for a healthy and sustainable lifestyle. This concept has been adopted in many cities worldwide, including New York City's Time Square, known for its bustling public life. He has also influenced city planning policies. For instance, in 2009, the City of Copenhagen enacted "A Metropolis for People", a plan that aimed to make Copenhagen the most livable city in the world in 2015. The plan focused on three main components: encouraging more walking, spending more time in public spaces, and breaking free from "private cocoons". This approach made the city more exciting, interesting, safer, and promoted social inclusion.

2.2. SPACE SYNTAX IN URBAN DESIGN

Space syntax, developed by Bill Hillier and Julienne Hanson in the early 1980s, with roots in the 1970s, is a framework for analyzing the spatial configuration of urban environments and its impact on social behavior. Their seminal work, 'The Social Logic of Space' (1984), provides tools for urban planners to understand the built environment's effects on people.

Central to space syntax is the concept of spatial configuration, which examines relationships between spaces within urban environments. This approach posits that spatial layout influences human social activity. Space syntax enables the analysis and prediction of behaviors in a city, such as pedestrian movement and wayfinding, based on spatial relationships.

Hillier (1993) further advanced techniques to predict spatial outcomes, leading to the development of software like DepthmapX (Space Syntax Lab, UCL), widely used for quantitative analysis of spatial configurations. These tools help urban planners predict pedestrian movement, assess connectivity, and evaluate social dynamics in public spaces.

Space syntax has been effectively applied in projects such as the redesign of Trafalgar Square and the London Olympic Park, where it guided decisions that enhanced walkability and functionality. These cases demonstrate space syntax's role in creating vibrant, socially cohesive urban environments.

2.2.1. Axial Lines and Isovists in Space Syntax

In space syntax, the most commonly used representations are axial maps and isovists. Axial maps consist of the longest lines of sight and movement through space, representing potential pathways for pedestrian movement. This model is particularly useful for analyzing the spatial configuration of an area, closely resembling computational studies of wayfinding (Kuipers, 1998).

Isovists, on the other hand, capture the field of view from a specific point, providing insights into how visible different areas of a space are. The isovist model is more visual than the axial line model and allows for mapping based on the attenuation of local characteristics, which is especially useful in the arrangement of enclosed spaces (Benedikt M. L., 1979). By using the isovist model, it is possible to analyze the effect of visual cues on the perception of space. This model considers the visibility of a point from different locations in space, making it ideal for studies that focus on the visibility and perception within urban environments.

The choice of which model to use depends on the specific research questions being asked. If the aim is to understand how visual cues affect perception and movement in enclosed spaces, the isovist model may be more appropriate. However, if the focus is on the spatial configuration of an area and how this influences pedestrian movement, the axial line model may be a better fit.

2.2.2. Visibility Analysis in Space Syntax

Visibility graph analysis is a spatial modeling method closely tied to spatial perception aspects such as wayfinding, movement, and space use (Turner, Doxa, O'Sullivan, & Penn, 2001). The process involves abstracting architectural forms into a system of barriers and permeabilities, dividing space into grids, and calculating the relationships of each cell with the system based on its isovists - volumes of space visible from specific points. This analysis is valuable for understanding spatial mobility, including how people navigate spaces and perceive central versus peripheral areas (Benedikt & Burnham, 1985). Key types of visibility analyzed include:

- **Global Visibility**: Overall visibility of a space from a single vantage point.
- **Local Visibility**: Visibility of specific areas within the space from a given point.
- **Visual Permeability**: Degree to which an area's spatial layout enables or obstructs visual access between different areas of the space.

A novel approach in the current study is to combine measurements of visibility and movability into a single indicator, based on the assumption that people tend to move where they can see while avoiding corners. This approach enhances our understanding of pedestrian movement and underscores the importance of visibility in space syntax analysis. Visibility is a crucial consideration because it directly impacts the functionality and safety of public spaces, guiding how people navigate and interact within these environments.

2.2.3. Challenges and Considerations

While Space Syntax analysis offers valuable insights into the spatial configuration of urban environments, it presents several challenges and considerations that must be acknowledged:

- **Data Availability and Quality**: The accuracy of Space Syntax analysis is highly dependent on the availability and quality of spatial data, including street networks, building layouts, and land use patterns. Collecting and maintaining accurate data can be resource-intensive, especially in fast-changing urban environments (Hillier & Hanson, 1984).
- **Interpretation and Methodological Limitations**: Space Syntax reduces urban morphology to spatial axes, which might oversimplify the complexity of urban forms (Batty, 2001). Interpreting results demands careful consideration of specific urban contexts, including cultural, historical, and socioeconomic factors, to avoid misinterpretation.
- **Social and Cultural Factors**: A key limitation of Space Syntax is its focus on physical space, often overlooking the social and cultural factors that influence interactions with environments. While spatial configuration significantly affects pedestrian movement, it doesn't fully consider social and cultural processes or the varied experiences and preferences of pedestrians based on gender, age, or cultural background (Jiang & Claramunt, 2004).
- **Interdisciplinary Collaboration**: Addressing these challenges requires collaboration across multiple disciplines, including architecture, sociology, and transportation planning. Such interdisciplinary efforts are crucial for overcoming the methodological limitations of Space Syntax and developing more holistic urban space analysis approaches (Penn, 2003).

2.3. BEHAVIORAL MAPPING AND ITS INTEGRATION WITH SPACE SYNTAX

Behavioral mapping is a qualitative research method that involves the systematic observation and recording of human behavior in public spaces. This approach is widely used in urban studies to understand how people interact with their environment, identify patterns of use, and evaluate the effectiveness of public space designs. Jan Gehl's method of observation exemplifies this practice, involving direct observation of public spaces at various times and across different seasons to capture a broad spectrum of activities and behaviors. By documenting where people gather, how they move through space, and what activities they engage in, behavioral mapping provides valuable insights into the social dynamics of public spaces.

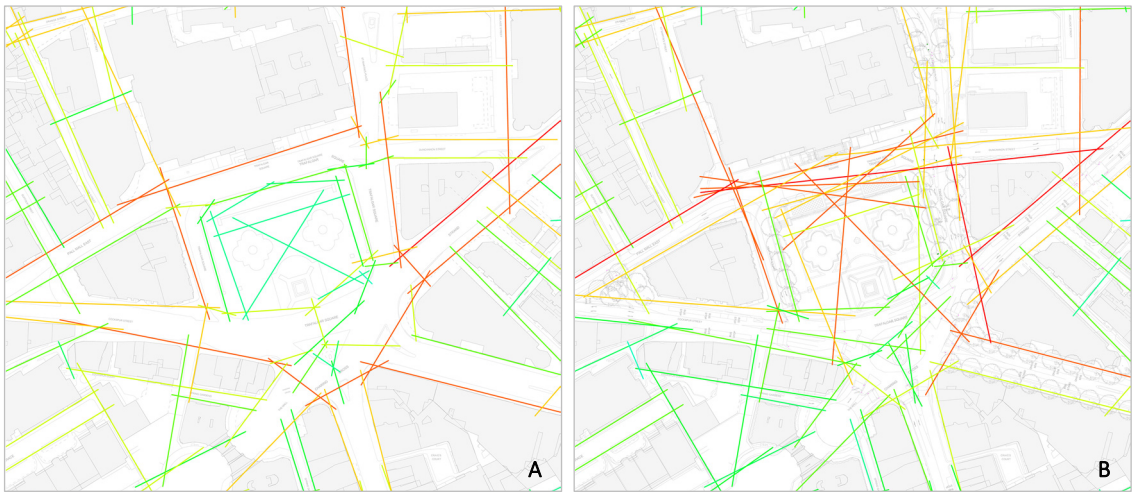
The integration of space syntax with behavioral mapping represents a powerful approach to urban design research. While space syntax provides a quantitative analysis of spatial configurations, behavioral mapping offers qualitative insights into how people actually use these spaces. Combining these methods allows for a more comprehensive understanding of the relationship between spatial design and human behavior.

One of the key benefits of this integrated approach is its ability to validate and refine spatial analysis findings. For instance, space syntax might predict areas with high potential for pedestrian movement based on spatial configuration, but behavioral mapping can reveal whether these areas are actually being used as anticipated. This combination of methods enables a more nuanced analysis of public spaces, considering both the theoretical potential of the space and the actual experiences of its users.

Moreover, integrating space syntax and behavioral mapping supports the development of more effective design guidelines. Understanding how spatial configurations influence behavior provides insights into how public spaces can be made more responsive to the needs and preferences of their users.

2.4. CASE STUDIES IN PUBLIC SPACE DESIGN

The application of space syntax and behavioral mapping in urban design is best illustrated through case studies that demonstrate the effectiveness of these methods in real-world settings. These case studies demonstrate the practical applications of space syntax and behavioral mapping in urban design. They show how these methods can be used to enhance the functionality, accessibility, and social vitality of public spaces, contributing to the creation of more livable and sustainable urban environments.



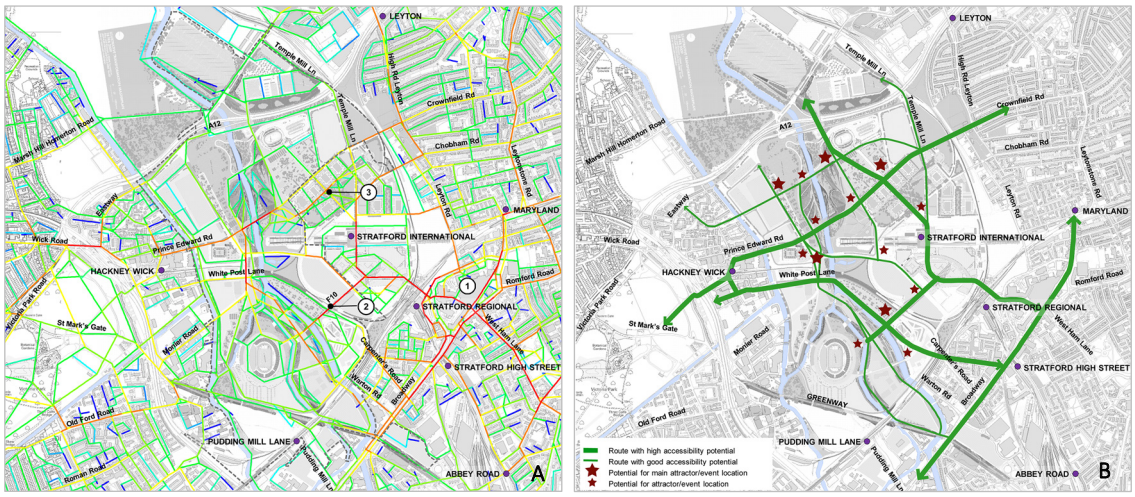
[4] Spatial accessibility model of Trafalgar Square, London, 1998. (A) Before implementation, (B) After implementation. (Source: https://spacesyntax.com/project/trafalgar-square/)

2.4.1. Trafalgar Square, London, UK (1998)

In 1998, Space Syntax analysis was conducted on Trafalgar Square in Westminster to understand and improve pedestrian movement within the area. The Westminster City Council and Greater London Authority had earlier commissioned a master plan in 1996, recognizing the need to enhance the space, which was struggling with safety issues and being overrun by vehicular traffic despite its historic importance.

The initial analysis revealed two critical issues: Londoners tended to avoid the center of Trafalgar Square, and tourists rarely ventured between Trafalgar Square and Parliament Square [Figure 4. A]. This underutilization was largely attributed to the dominance of vehicle traffic in the area. To address these challenges, advanced Space Syntax models were employed to analyze pedestrian movement patterns in detail.

The analysis recommended significant design interventions, including the construction of a large staircase leading to a pedestrianized terrace in front of the National Gallery. This design was aimed at encouraging people to walk through the square, thereby enhancing pedestrian accessibility and overall engagement with the space [Figure 4. B].



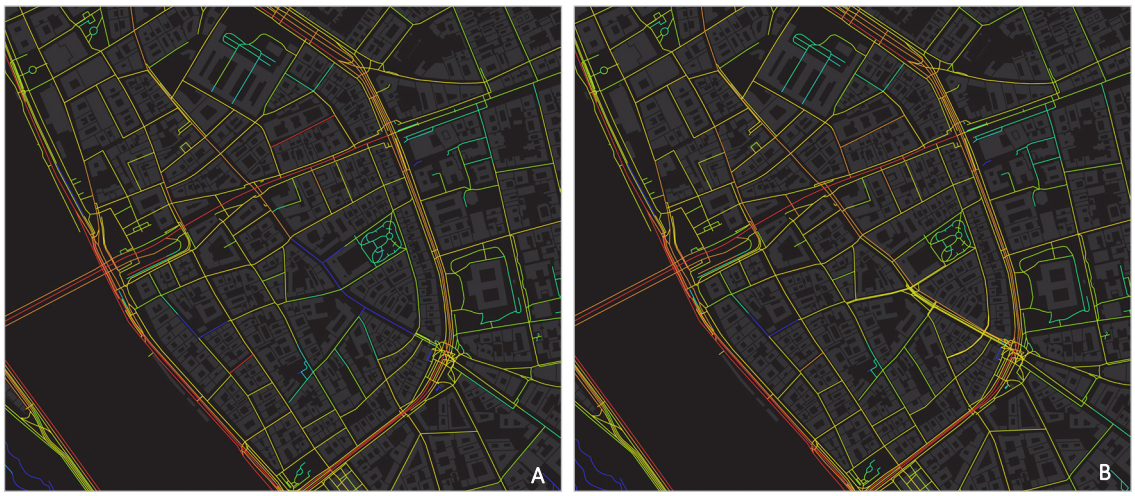
[5] Spatial Accessibility analysis of the Olympic Park in its Transformation Phase. (A) Local spatial accessibility model of the existing conditions, (B) Diagram summarizes recommended linkages and locations for attractors/events. (Source: https://spacesyntax.com/project/london-olympic-park-urban-integration-transformation-phase/)

2.4.2. Olympic Park, London, UK (2012)

The London 2012 Olympic and Paralympic Games spurred the development of extensive public realm infrastructure. To ensure effectiveness during and after the Games, the movement network for pedestrians and cyclists was designed to integrate seamlessly with the wider urban street grid, connecting the Park to areas like Stratford town center and the Stratford City retail development.

The infrastructure aimed to accommodate pedestrian, cycle, and vehicle movements, create safe and convenient connections, provide spaces for leisure and recreation, and ensure that commercial activities were efficiently connected by the movement network. The Olympic Delivery Authority (ODA) commissioned Space Syntax to conduct a Spatial Accessibility analysis during the Transformation Phase (2012-2014). As shown in Figure 5. A, this analysis revealed the significant impact of spatial accessibility on pedestrian movement patterns, influencing the area's social, economic, and environmental performance.

Spatial models assessed the integration of proposed designs within the broader urban context and identified potential sites for attractions and events [Figure 5. B]. Space Syntax's recommendations were incorporated into the revised public realm design by the ODA.



[6] Axial model of Egyetem Square (A) before renovation in 2010 (B) After renovations in 2010
(Source: Sirjani & Szabó, 2023)

2.4.3. Egyetem Tér, Budapest, Hungary (2010)

Egyetem Tér in Budapest underwent a significant redesign in 2010, aimed at transforming the space into a more pedestrian-friendly and accessible public area. Although space syntax analysis was not utilized in the original design process, a subsequent analysis conducted provided valuable insights into the spatial configuration and usage of the space (Sirjani & Szabó, 2023). Figure [6] demonstrates some findings from the Space Syntax analysis:

Connectivity: Areas of the square were poorly connected to surrounding streets, with the elevated transportation hub acting as a barrier.

Pedestrian-friendly design: The analysis identified pedestrian movement patterns and areas where clearer routes could enhance flow.

Safety: Poor visibility and blocked sightlines were highlighted, suggesting the need for improved lighting and safety measures.

Activity: The analysis identified areas with potential for increased activity, guiding the placement of new seating and green spaces.

Before the 2010 renovation, Egyetem Tér was primarily a congested traffic hub, making pedestrian navigation difficult and unsafe. The area was visually unappealing, with minimal greenery and amenities, and lacked accessibility for people with disabilities, creating an uninviting atmosphere. Recognizing the square's potential, local residents and officials initiated a comprehensive redesign to create a more welcoming and accessible public space, with a focus on improving pedestrian flow and encouraging activity.

Thesis 2 - Integrating Environmental and Social Considerations in Public Space Design

Incorporating environmental and social factors into public space design is essential for developing urban environments that are sustainable and enhance community well-being. Public spaces must address the diverse needs of urban populations by considering how spatial arrangements influence behavior, movement, and interaction. By analyzing key elements like paths, edges, and landmarks, designers can create environments that are easy to navigate and inviting for pedestrians. Understanding how people experience spaces as they move through them allows for the creation of designs that evoke emotional and psychological responses, ensuring spaces are engaging and comfortable.

Additionally, observing how people actually use public spaces provides practical insights that inform more effective design strategies. This approach ensures that public spaces are designed to meet the practical needs and behaviors of the community, making them both functional and relevant in daily life. The goal is to create spaces that support social interaction, improve accessibility, and contribute to a higher quality of urban life.

3. DESIGN RESEARCH

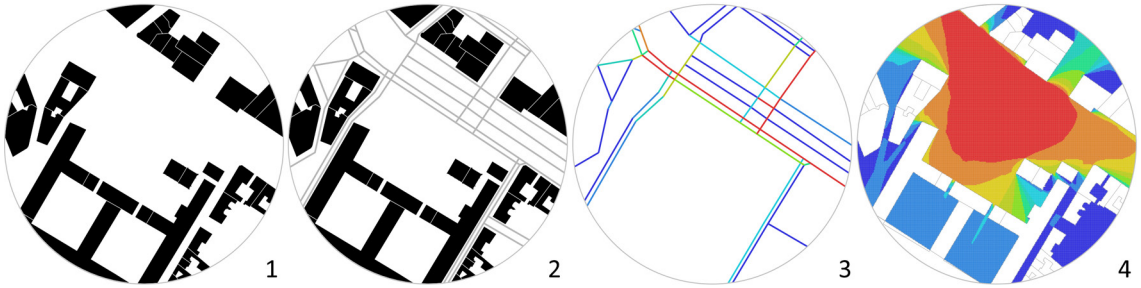
This study employs a systematic approach to evaluate the spatial dynamics of an existing public space, using a combination of space syntax analysis and behavioral mapping. Unlike traditional design processes that create new spaces, the focus here is on critically analyzing an existing area to understand its spatial dynamics and improve its functionality.

The analysis process is structured into three phases:

1. **Space Syntax Application (DepthmapX)**: This phase uses space syntax tools to quantitatively assess the spatial configuration, connectivity dynamics, and visibility parameters within the public space. The goal is to understand how the layout influences pedestrian movement and social interactions.
2. **Qualitative Analysis (Behavior Mapping)**: Drawing from Jan Gehl's observational methods, this phase captures real-time insights into how users interact with the space. It provides qualitative data on public life experiences, highlighting how people use and experience the environment.
3. **Integration of Quantitative and Qualitative Methods**: In the final phase, findings from space syntax analysis are integrated with behavioral mapping data. This integration provides a comprehensive understanding of the relationship between spatial configuration and user behavior, offering a holistic view of public space functionality.

3.1. SPACE SYNTAX APPLICATION

The application of space syntax analysis is regarded as a valuable approach for the creation of user-centered public spaces. By utilizing space syntax principles, the understanding of pedestrian movement and decision-making within these spaces can be facilitated. In this chapter, a step-by-step methodology for the integration of space syntax analysis into the design process of public spaces will be presented.



[7] The key steps of utilizing space syntax method (Source: Author)

Figure [7] represents the key steps involved: (1) modeling and drawing the base map, including building boundaries and spatial configuration, (2) generating possible walking paths and axial lines, (3) importing lines into the DepthmapX (Space Syntax Lab, UCL) software for connectivity, integration, and choice analysis, and (4) conducting visibility analysis.

By adopting this practical guide, the arrangement of urban elements can be optimized, leading to further analysis within public spaces.

3.1.1. Modeling Building Boundaries and Spatial Configuration of Urban Blocks

In the initial stage, it is essential to create a comprehensive base map that includes the layout of urban blocks and the boundaries of buildings. This step involves accurately modeling and drawing the existing physical elements within the study area. By capturing the spatial arrangement of buildings and urban blocks, the foundation for conducting space syntax analysis is laid. This detailed representation is crucial as it provides a clear understanding of the existing urban fabric, allowing for precise analysis and planning. The base map serves as a critical tool for visualizing the spatial relationships and interactions within the area, which are fundamental for effective urban design and planning.

The process begins with the collection of accurate geographical data, which is then used to model the urban blocks and building boundaries. This involves the use of Computer-Aided Design (CAD) software to ensure precision.

3.1.2. Generating Possible Walking Axial Lines from OpenStreetMap

Once the base map is established, the next step is to identify and analyze potential walking paths within the public space. This can be achieved through two primary methods: drawing hypothetical paths based on knowledge or utilizing mapping tools such as OpenStreetMap (OSM) to generate pedestrian routes.

Drawing hypothetical paths involves leveraging the expertise of urban planners to predict likely pedestrian routes, considering factors such as desire lines, accessibility, and connectivity. These paths are then represented as axial lines, which are the longest straight lines that can be drawn through the open space without intersecting any barriers. Axial lines are fundamental in space syntax analysis as they represent the potential movement paths within an urban environment.

Alternatively, OpenStreetMap (OSM) provides a data-driven approach, generating accurate walking paths based on existing geographical information. OpenStreetMap is a collaborative project that creates a free, editable map of the world, built by a community of mappers who contribute and maintain data about roads, trails, cafés, railway stations, and much more, all over the globe. This method involves exporting the OpenStreetMap data from the chosen area and using a vector-based software to generate axial lines that reflect actual pedestrian routes. These lines are then analyzed using space syntax software such as DepthmapX (Space Syntax Lab, UCL) to assess various metrics, including connectivity, integration, choice, and visibility within the urban environment.

3.1.3. Space Syntax Analysis with DepthmapX: Connectivity, Integration, and Choice

To conduct a detailed space syntax analysis, the lines representing the walking paths are imported into specialized software such as DepthmapX (Space Syntax Lab, UCL). This software enables the application of various space syntax techniques to evaluate the connectivity, integration, and choice within the public space.

a) **Connectivity Analysis**: Axial and segment analysis in DepthmapX (Space Syntax Lab, UCL) assess the network connectivity of walking paths, revealing the prominence and importance of different routes and identifying key connections and potential bottlenecks.

b) **Integration Analysis**: This analysis measures the integration of spaces within the network, identifying central locations and highly integrated areas that are crucial for enhancing accessibility and promoting social interaction.

c) **Choice Analysis**: This technique help understand pedestrian decision-making behavior within the public space, revealing the attractiveness and preference of different routes, which informs the design of engaging and well-utilized pathways.

3.1.4. Visibility Analysis

In addition to connectivity, integration, and choice analysis, visibility analysis plays a crucial role in designing public spaces. Visibility analysis, facilitated by tools such as DepthmapX (Space Syntax Lab, UCL) software, assesses the visual permeability and sightlines within a space (Turner, Doxa, O'Sullivan, & Penn, 2001). This type of analysis is essential for understanding how people perceive and navigate through an environment, which directly impacts their sense of safety, ease of wayfinding, and overall aesthetic experience (Gehl, 2010).

Through visibility analysis, the visual fields and sightlines from various vantage points within the public space are examined. This process identifies areas that are visually accessible and highlights those that are obscured or hidden. Such information is crucial for optimizing the placement of urban elements, including pathways, seating areas, lighting, and landscaping, ensuring that the space is both functional and inviting (Turner, Doxa, O'Sullivan, & Penn, 2001).

One of the primary benefits of visibility analysis is its contribution to enhancing safety within public spaces. By ensuring clear and unobstructed sightlines, the analysis helps to minimize blind spots, thereby creating environments where individuals feel more secure. This is particularly significant in urban settings, where high visibility can act as a deterrent to criminal activity and foster a stronger sense of community (Hillier, 2007).

Visibility also plays a key role in wayfinding, as clear sightlines help individuals navigate the space more easily, reducing confusion and improving the overall user experience. Effective wayfinding design, informed by visibility analysis, allows people to move through the space intuitively, making it more accessible and user-friendly (Arthur & Passini, 1992).

Aesthetic appeal is another aspect profoundly influenced by visibility. Well-designed sightlines can emphasize important landmarks, create pleasing vistas, and enhance the visual coherence of the space (Lynch, 1960). By strategically positioning elements to frame views and establish focal points, the overall aesthetic quality of the public space can be significantly improved, making it more attractive and enjoyable for its users (Gehl, 2010).

3.2. BEHAVIOR MAPPING: GEHL'S METHOD OF OBSERVATION

This chapter explores the potential between Gehl's method of observation and space syntax analysis to achieve a more comprehensive understanding of public spaces and their user experience. Gehl's method emphasizes direct observation and qualitative assessment of human behavior within the built environment, while space syntax analysis provides quantitative insights into spatial configurations and their influence on pedestrian movement. By combining these approaches, a deeper understanding of the interplay between spatial design, human behavior, and the overall quality of public spaces can be gained. Further, practical strategies for integrating Gehl's method of observation within the framework of space syntax analysis can be analyzed, highlighting the benefits of this combined approach and its potential for informing effective design decisions.

3.2.1. Use of behavior mapping

In the early stages of analysis, conducting on-site observations and developing pedestrian flow maps serves as a foundational step to gain a comprehensive understanding of the urban environment under study. This analysis delves into the practical methodology involved in this process. Before embarking on the on-site observations, it is crucial to define the specific area within the site that will be the focus of analysis. This definition is guided by research objectives, the spatial hierarchy of the site, and the diversity of activities occurring within it. Once the area is analyzed, it remains a constant reference point throughout the observations. The large size and non-visibility between parts of the space for example would make observations inaccurate. As a result, the space is subdivided into subspaces, using some physical objects as landmarks for their delimitations.

3.2.2. Temporal Variation and Data Collection

To capture the full spectrum of activities and spatial behaviors, observations are conducted at different times of the day, on various days of the week, and across multiple months. This temporal variation is crucial for accounting for seasonal changes, fluctuations in pedestrian flows, and varying patterns of land use, thus ensuring that the analysis considers the dynamic nature of public spaces. The strategic selection of observation times - morning, afternoon, and evening - across different days of the week, including workdays and weekends, is essential. These variations allow the research to document distinct patterns of activity influenced by daily rhythms and special events, resulting in a comprehensive dataset.

During these on-site visits, a wide range of data is collected, including:

- **Pedestrian Movements**: Tracking the paths and trajectories of pedestrians, noting common routes, and identifying points of convergence or divergence.
- **Social Interactions**: Documenting instances of social interactions, such as gatherings, conversations, and participation in communal activities.
- **Land Use and Activities**: Recording the types of land use and activities within the site, distinguishing between commercial, recreational, and residential functions.

3.2.3. Mapping and Documentation

Concurrent with the data collection, behavior maps or annotated physical maps are created to visually represent the observed behaviors and spatial characteristics. These maps include:

- **High-Traffic Areas and Pedestrian Flow Patterns**: Marking the locations of concentrated pedestrian activity and typical movement paths.
- **Significant Gathering Points or Social Hubs**: Identifying key areas where people naturally congregate for social interaction.
- **Transitions Between Different Land Uses or Activity Zones**: Indicating shifts in land use or activity types across the space.

Behavior mapping techniques analyze how spatial configuration impacts pedestrian flow and movement patterns. This process highlights areas of high or low activity, identifies bottlenecks or underutilized spaces, and suggests improvements to enhance public space functionality and user experience. Figure [8] represents an example of behavior mapping at Trafalgar Square in London (Source: https://spacesyntax.com/project/trafalgar-square/).

[8] Behavior mapping, Trafalgar Square, London, 1998. (Source: https://spacesyntax.com/project/trafalgar-square/)

3.3. INTEGRATION OF SPACE SYNTAX WITH BEHAVIOR MAPPING

3.3.1. Balancing Integration and Segregation Analysis for Optimal User Experience

Public spaces are essential to urban environments, enhancing well-being, livability, and community cohesion. Designing these spaces requires balancing integration and segregation. Integration, analyzed through space syntax, emphasizes accessibility, connectivity, and social cohesion, while segregation involves the deliberate separation of areas to serve specific functions and create diverse experiences (Hillier, 2007). This chapter examines the relationship between integration and segregation in public space design to create inclusive, vibrant environments. Integration fosters social connectivity, efficient movement, and safety, whereas segregation allows for distinct zones with unique functionalities and ambiance.

A balanced approach to integration and segregation enables public spaces to meet diverse needs, offering areas for social interaction, relaxation, and contemplation. By considering the benefits and challenges of both concepts, this chapter provides insights into optimizing spatial arrangements in public spaces to create engaging and harmonious environments for all users.

3.3.2. Integration in Space Syntax: Increasing Accessibility and Connectivity

Integration, a key concept in space syntax analysis, focuses on the accessibility and connectivity of spatial elements within the urban fabric (Hillier & Hanson, 1984). Prioritizing integration in public space design enhances overall functionality, user experience, and the sense of connectedness among visitors. Understanding and applying integration principles contribute to creating spaces that are inclusive, navigable, and promote positive experiences for individuals of all abilities.

Below are the specific ways in which these principles enhance the overall functionality and user experience in public spaces:

Enhancing Accessibility: Ensuring public spaces are reachable and usable by diverse individuals involves examining spatial configuration and connectivity to identify potential barriers and inefficiencies. This knowledge supports informed design decisions, promoting inclusive environments with accessible pathways, ramps, elevators, and the removal of physical and perceptual barriers (Marcus & Legeby, 2012).

Fostering Social Connectivity: Designing well-integrated and connected spaces facilitates encounters, interactions, and social cohesion. This approach encourages exploration, movement, and community building, turning these spaces into hubs for meeting and social activities, thereby enhancing the community's social fabric (Legeby, 2013).

Enhancing Safety and Security: Clear lines of sight and minimizing hidden areas are essential for safety. Improved visibility and connectivity create public spaces that feel safer and more secure. Adequate lighting, open sightlines, and strategically placed design elements further enhance this sense of safety, encouraging more frequent use (Hillier, 2007).

Supporting Efficient Movement and Circulation: Optimizing connectivity minimizes congestion and improves pedestrian flow. Well-integrated spaces offer intuitive navigation, reducing confusion and ensuring a seamless experience for park visitors (Penn, 2003).

3.3.3. Segregation in Space Design: Creating Spaces for Rest and Tranquility

Segregated areas within public spaces play a crucial role in meeting the varied needs and preferences of park visitors. While vibrant, active areas foster social interaction and recreational activities, segregated spaces offer benefits for individuals seeking tranquility, peace, and a moment of respite. These designated areas within public parks contribute to creating environments conducive to rest, relaxation, and a sense of calmness. The presence of such spaces supports well-being, mental rejuvenation, and a harmonious balance between active and passive uses. To better understand the significance of segregated spaces, we can explore several key aspects:

Restorative Environments

Designing public parks requires considering diverse visitor needs. While active areas are vital for social interaction, segregated spaces offer tranquility and rest, providing a retreat from urban life. Hillier (2007) discusses the importance of spatial configuration in creating environments that support both social interaction and individual well-being, noting that carefully designed spaces can enhance mental and emotional restoration.

Rest and Relaxation

Segregated areas in parks serve as spaces for rest and relaxation, often featuring comfortable seating, shade, and peaceful landscaping. These zones cater to those seeking solitude or quiet activities like reading, offering a balanced environment that accommodates both active and passive uses (Marcus, 2010).

Encouraging Reflection and Contemplation

Segregated areas in parks provide opportunities for reflection and mindfulness, free from noise and distractions. Designed with tranquil elements like water features and scenic vistas, these spaces enhance cognitive function and emotional well-being. Legeby (2013) emphasizes the role of spatial segregation in creating quiet, contemplative environments within urban settings, which can be crucial for psychological well-being.

Supporting Well-being and Mental Health

Segregated areas in parks contribute to visitors' mental health by offering spaces for stress relief and relaxation. These quiet retreats make parks more inclusive, ensuring that those seeking solitude have a place to unwind. Penn (2003) argues that the strategic placement of such spaces within urban parks can enhance the overall well-being of the community by providing necessary escapes from the urban environment.

Thesis 3 - Enhancing Public Space Design through a Post-Design Evaluation Stage

Introducing an evaluation stage between design and implementation, utilizing space syntax analysis, enhances the alignment of public space designs with human-scale needs. This evaluation phase focuses on the spatial configuration of proposed designs, ensuring that public spaces are functional, safe, and visually accessible before they are finalized. Space syntax analysis quantitatively examines the relationships between spatial elements, providing insights that help refine sightlines, optimize pedestrian flow, and improve overall safety.

However, while space syntax offers valuable quantitative data, it is crucial to pair this with observational methods to fully understand how these spaces will function in practice. Observational methods deliver qualitative insights into how people interact with and experience the environment. Integrating these approaches during the evaluation phase ensures that the final design is better aligned with human-scale needs and the broader urban context. This comprehensive strategy helps avoid design flaws and supports the long-term success and sustainability of public space projects.

4. CASE STUDY

Városháza Park, situated in the heart of Budapest on Károly Boulevard, is a significant public space with a rich history and an essential role in the urban fabric. Adjacent to the City Hall, the park provides a central location for relaxation and social interaction, making it a vital part of Budapest's urban landscape.

Historically, Városháza Park has been closely linked to the City Hall, with its identity shaped by this proximity. Over the years, numerous proposals were made to renovate the City Hall, reflecting the changing needs and aspirations of different eras. For decades, the valuable courtyards of the City Hall were used for operational purposes and were inaccessible to the public. However, in 2019, a major change occurred when the previously restricted VIP parking lot of the City Hall was opened to the public, transforming it into a space for cultural programs and social forums. This was a significant step toward making the City Hall more accessible and integrated with the public realm. In conjunction with the 150th anniversary of Budapest's unification, comprehensive renovations of both the interior and exterior of the City Hall are now underway.

In 2021, an architectural competition was held to redesign Városháza Park (Budapest.hu, 2021). From among 18 applicants, the winning design by Lépték-Terv Tájépítész Iroda was selected [Figure 9]. This design aims to transform the park into a sustainable green space, a public forum, and a performance venue. It includes features such as a landscaped area designed to withstand summer heatwaves, spaces for public encounters and debates, and a showcase for cultural events. Additionally, the renewal project includes the renovation of the Town Hall façade on Károly Boulevard and the nearby building that formerly housed the Merlin Theatre.

The competition designs all shared the goal of turning Városháza Park into an open, green square that fosters community engagement and dialogue. However, the 1st and 2nd prize-winning designs, selected for this case study, were chosen for their recognition and the distinct approaches they took in addressing this objective [Figure 10]. These designs offer different spatial configurations, circulation patterns, and user experiences, which are expected to produce varied results in space syntax analysis and behavioral observations.

[9] Site plan of the Design A: 1st prize winner of the Városháza Park competition.

[10] Site plan of the Design B: 2nd prize winner of the Városháza Park competition.

These winning entries stood out not only for their innovative approaches and creativity but also for their alignment with the competition's objectives, making them prime subjects for in-depth exploration. The decision to focus on these two designs allows for a comprehensive examination of the impact of design on public space dynamics. This case study aims to explore the complex interplay between spatial layout, human movement, and user behavior through the combined lenses of space syntax analysis and observational methodology, following the principles advocated by Jan Gehl.

The decision to analyze the 1st and 2nd prize-winning designs strategically highlights the diverse possibilities in contemporary architectural and urban design, using these distinct approaches to explore how design influences public space dynamics and community interaction.

[11] Design A: 1st Prize design of Városháza Park competition, Lépték-Terv Tájépítész Iroda.
(Source: https://budapest.hu/hirek/2022/04/29/bemutatjuk-a-varoshaza-park-tervpalyazat-eredmenyeit)

4.1. DESIGN A: 1ST PRIZE: LÉPTÉK-TERV TÁJÉPÍTÉSZ IRODA

The project reorganizes the spatial layout of Városháza Park by introducing a distinctive circular green space within the site. As illustrated in Figure 11, this circular design effectively divides the courtyard area, enabling varied use of the resulting spatial segments while maintaining the structural connections within the spatial system. The incorporation of the circular motif serves as a symbolic representation of a 'central place', signifying the heart of the area.

The Judging Committee recognized the project's exceptional quality, highlighting its strong character, effective functional solutions, and outstanding professionalism as top-tier (Budapest.hu, 2022).

From this point forward, this design will be referred to as '**Design A**' in the subsequent sections of this study.

[12] Design B: 2nd Prize design of Városháza Park competition, CAN Architects Studio Kft. + Újirány Tájépítész Kft. (Source: https://budapest.hu/hirek/2022/04/29/bemutatjuk-a-varoshaza-park-tervpalyazat-eredmenyeit)

4.2. DESIGN B: 2ND PRIZE: CAN ARCHITECTS STUDIO KFT. + ÚJIRÁNY TÁJÉPÍTÉSZ KFT.

The primarily park-centered design, as depicted in Figure 12, is a clear, simple, and consistent structure that seeks an ecological response to the design of the classical city hall square. It correctly identifies the shortcomings of the Baroque City Hall facade and makes logical additions, including architectural proposals for the reversal of the currently rear courtyard facade.

It subordinates the existing City Hall and the city's direct connection to the concept of a classic main square, creating a transversal main square perpendicular to the main facade that establishes a connection between the historical surroundings of the City Hall and the busy inner city ring road. The design retains the central axis of the City Hall, which does not coincide with the axis of Madách Square in this case, but this does not create uncertainty; on the contrary, it subtly alludes to the temporal and spatial fragmentation and shifts of the planned 'Madách Boulevard'.

The Jury found the entry to be an overall well-thought-out and logical proposal that strongly represents the immediate surroundings of the historical City Hall and the concept of an open city (Budapest.hu, 2022).

From this point forward, this design will be referred to as '**Design B**' in the subsequent sections of this study.

5. EVALUATION PROCESS

In the analysis process of this research, the utilization of existing public spaces is systematically investigated, with a focus on both stationary and non-stationary activities or positions: sitting, standing people, and moving people. Therefore, to investigate whether there is any correlation between the utilization of space and the spatial properties of a specific area in public space, and to explore connections between visibility and spatial use. Specifically, attention is directed towards the visual aspects shaped by the layout and architectural elements in the space, which play a crucial role in influencing how individuals interact with and traverse through the space.

The connection between visibility and the utilization of space is examined, exploring how design elements impact the overall functionality and experience for individuals utilizing the public space. To comprehensively understand pedestrian usage and space utilization across all sections of the area, a combination of qualitative and quantitative analysis techniques is employed. These methods aid in unraveling the intricate relationship between design elements, human behavior, and the spatial structure of the public space. Throughout this process, the aim is to bridge the gap between theoretical concepts derived from space syntax analysis and practical recommendations for enhancing the studied public spaces.

5.1. ANALYSIS OF EXISTING PUBLIC SPACE DESIGN

5.1.1. Use of behavior mapping

Behavior mapping techniques are applied to understand how people perceive and utilize Városháza Park and its surrounding areas. Given the park's expansive size and the presence of obstacles like trees that limit visibility, accurately observing people's behavior presents challenges. To address this, the park is divided into smaller, more manageable sections using physical landmarks for reference.

The primary objective of this study is to explore the relationship between space occupancy and the inherent characteristics of the environment, regardless of the specific activities individuals are engaged in. The initial behavior mapping assessment indicates that certain areas, particularly those near public transport stations (Metro station and Tram 47/49) and major shopping streets, exhibit significantly higher occupancy levels [Figure 13]. This finding highlights the influence of both the park's design and its surrounding context on how different areas within the park are utilized by the public.

Behavior mapping in this study is particularly focused on examining the interaction between Városháza Park and its surrounding urban environment. This approach recognizes that external factors, such as proximity to public transport hubs and major shopping streets, play a crucial role in determining how different sections of the park are occupied. As Gehl (2011) notes, the surrounding urban infrastructure can profoundly influence public space utilization, underscoring the necessity of considering these external elements in behavior mapping analyses. The preliminary insights gathered here serve as a foundation for more detailed investigations into user behavior within this urban setting, allowing for a deeper understanding of the dynamics at play.

[13] The preliminary assessment of behavior mapping, Városháza Park and its surroundings. (Source: Author)

For the purposes of this analysis, the focus was placed on counting static individuals (those sitting or standing) and dynamic individuals (those engaged in activities involving movement), while deliberately excluding those who were merely passing through the space. This approach aligns with the methodologies suggested by Whyte (1980), who emphasized the importance of differentiating between transient and engaged users in public space studies. The initial findings suggest a strong correlation between space occupancy and the specific characteristics of the subdivided zones, particularly highlighting the higher levels of use in areas connected to major shopping streets. This early analysis underscores the importance of considering both the physical design of the park and the broader urban context in which it is situated.

5.1.2. Space Syntax: Visibility analysis

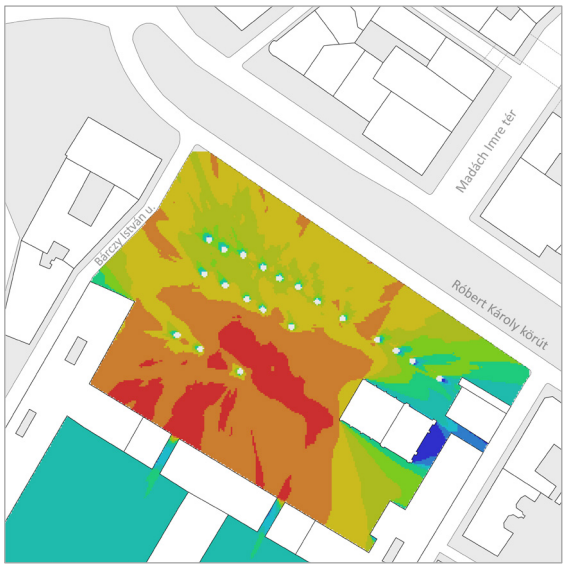
In this phase of the study, a 2D model of Városháza Park was imported into the 'DepthmapX' software (Space Syntax Lab, UCL), a widely recognized tool for spatial and visual analysis (Turner, Doxa, O'Sullivan, & Penn, 2001). This software facilitates a detailed examination of accessibility, visibility, and user movement patterns within the park, providing essential insights into its spatial dynamics.

The visibility analysis conducted within this framework involved the generation of isovists and Visibility Graph Analysis (VGA) for the park's existing layout. Isovists, which represent the set of all visible points from a specific location within a space, are crucial for understanding how users perceive and navigate the environment (Benedikt M. L., 1979). VGA, on the other hand, allows for the quantification of spatial properties such as integration and connectivity, which are key indicators of how users interact with the space.

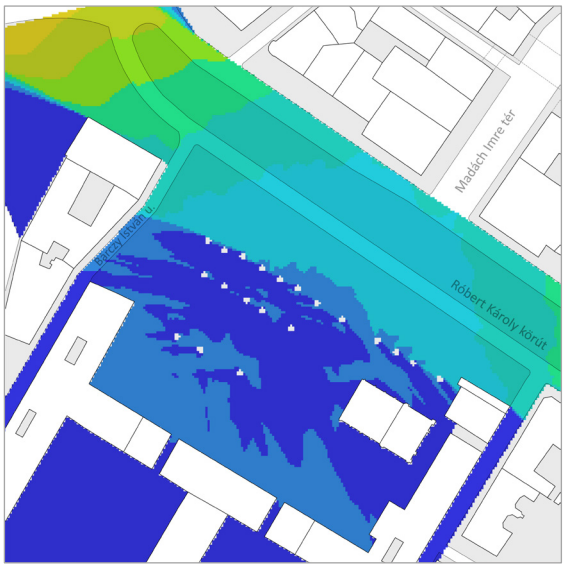
Integration Value: This metric evaluates how well subspaces within the park are visually integrated with each other, emphasizing the importance of spatial continuity and coherence (Hillier, 2007). High integration values indicate areas that are easily accessible and visible from many other parts of the park, which often correlate with spaces that are central to user activity and interaction. This measure focuses on the internal spatial boundaries of the park, assessing the visual connectivity among different areas.

Connectivity Value: Connectivity, in contrast, pertains to the visual accessibility of a space and its connection to the surrounding environment. This measure is essential for understanding the park's visual attractiveness and its functional links to the broader urban context (Hillier & Hanson, 1984). To accurately calculate connectivity, a grid with 70 cm squares was employed within the VGA graph, which is consistent with the human scale of movement and perception. This approach allows for a precise mapping of potential user movement routes, capturing how individuals might navigate both the central areas of the park and its periphery.

Overall, the visibility analysis offers critical insights into the degree to which Városháza Park is both internally integrated and externally connected within the broader urban fabric. The findings contribute to a comprehensive understanding of how spatial configurations influence perceptions of accessibility, visual cohesion, and the park's role as a public space within the city. This analysis highlights both the park's internal spatial dynamics and its significance as a visually integrated element within the urban environment, aligning with established theories in space syntax and urban design.



[14] Visual Step Depth in the center of the square.



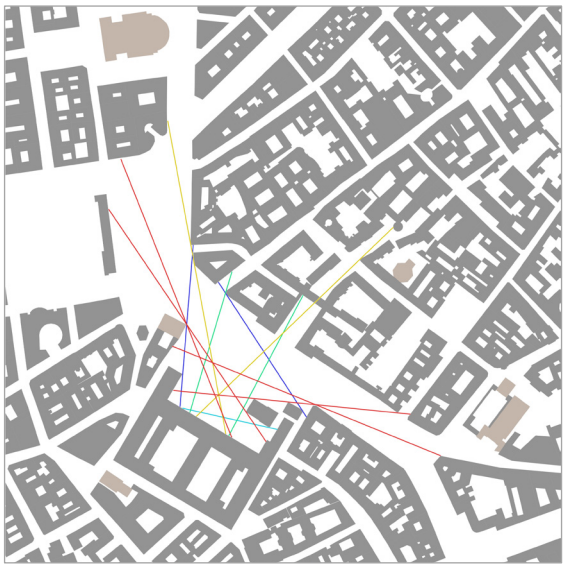
[15] Visual Step Depth from esplanade and surrounding streets.

Figure [14] illustrates the results of the Visibility Graph Analysis (VGA) for visibility integration within Városháza Park. The visual representation highlights areas within the park where integration is higher, with a particular emphasis on the central region. This is demonstrated by a greater Visual Step Depth in the center of the park, indicating that this area offers visibility in all directions except for the space behind Merlin.

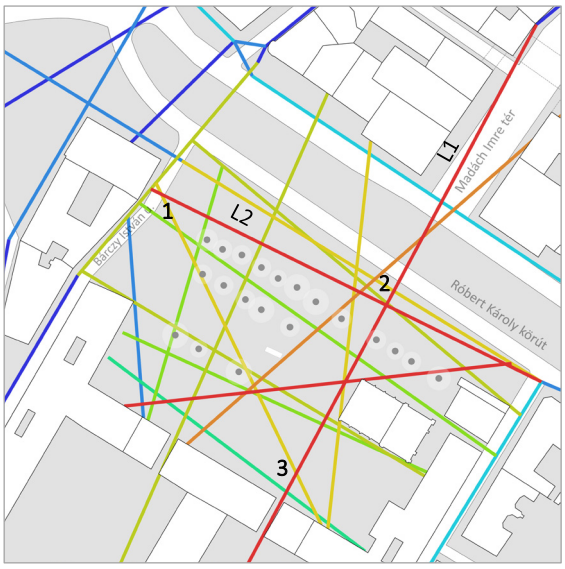
Visual Step Depth, which measures the number of steps needed to visually cover an area, indicates how much of the park is visible from a particular point. A higher Visual Step Depth in the central region suggests that from this vantage point, a larger portion of the park is visually accessible with fewer obstructions. This implies that the central area is more visually integrated, offering a greater sense of openness and interconnectedness. These highly integrated spaces are visually exposed, easily accessible, and well-connected to other areas within the park and adjacent urban spaces. Therefore, these central zones should be prioritized in public space design to enhance both visual and physical connectivity.

Figure [15] presents the outcomes of the analysis conducted on the streets surrounding the park. The visualization reveals that the central area of the park, particularly where it connects to the town hall, is prominently shaded in blue. In the context of VGA, blue shading typically indicates a lower level of integration or connectivity. This suggests that the central area, particularly in proximity to the town hall, exhibits limited visual connectivity with the surrounding urban fabric.

Visual Step Depth from the esplanade and surrounding streets indicates that the park is only partially visible from the esplanade due to the presence of certain obstacles, such as trees and landscape features. These obstructions increase Visual Step Depth by requiring more steps to see from one point to another, thereby lowering the perceived integration and accessibility of the central space. This partial segregation may limit movement between the park and adjacent urban areas, affecting how users perceive and use the space. Therefore, the design and management of visual obstructions, such as trees, should be carefully considered to improve the overall integration and accessibility of the public space within the urban context.



[16] Axial line analysis of space, focusing on buildings as the spatial configuration.



[17] Axial line analysis of space, integrating building configuration with the pedestrian network.

5.1.3. Space Syntax: Axial Line analysis

Axial line analysis, previously discussed as a key method in space syntax, involves using the longest visibility lines to assess spatial connectivity and integration across urban environments (Hillier & Hanson, 1984). This technique is particularly useful for understanding the interrelationship of public spaces within broader urban networks. In this study, both visibility analysis and axial line analysis are employed to gain insights into the design and functionality of Városháza Park and its surroundings.

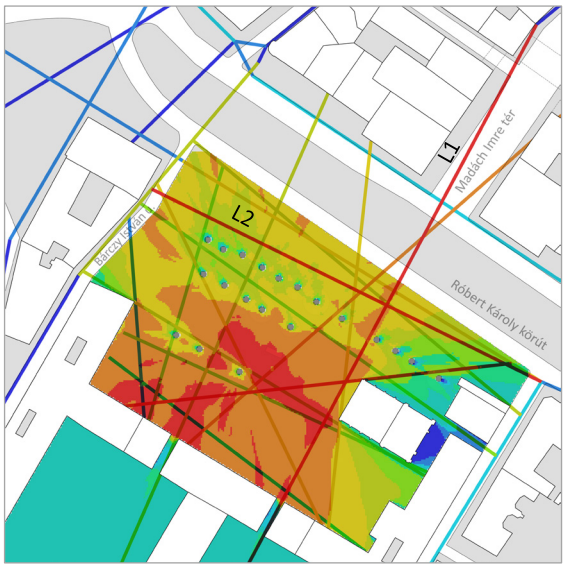
However, it's clear that while axial line analysis is useful for understanding spatial connectivity on a macro scale, its effectiveness can decrease in more detailed, smaller environments. Axial lines are great for highlighting main routes, central points, and important spaces within large urban networks, but they may miss the finer details of smaller areas where pedestrian interactions and local features are more significant.

Figure [16] illustrates an axial map that highlights the primary routes and connections within and around Városháza Park, focusing on its broader urban context. This larger-scale analysis reveals how the park integrates with its surroundings but also exposes the limitations of axial line analysis in capturing finer details, such as pedestrian paths and specific access points within more intricate environments.

Figure [17] addresses these limitations by integrating the pedestrian network, extracted from OpenStreetMap, with the axial lines. This combined visualization, which also considers building configurations, provides a more nuanced understanding of spatial integration. It highlights two major lines: L1, the most integrated line, characterized by its length, and L2, the most connected line. This enhanced approach reveals pedestrian flow patterns and emphasizes the significance of human movement and interaction in evaluating urban spaces.

In environments like the center of Városháza Park, characterized by more intimate spatial configurations and a pedestrian-focused design, visibility analysis emerges as a more suitable method. It provides highly relevant insights into how individuals interact within these confined spaces, particularly regarding accessibility, visual relationships, and user behavior. Conversely, in larger urban contexts or neighborhood-scale analyses, where the spatial network is more extensive and movement patterns are more diverse—such as along the visible edges of Károly Boulevard—axial line analysis proves more effective. It helps in understanding citywide circulation patterns, identifying key routes, and examining the interplay between different urban elements on a broader scale.

While both visibility and axial line analyses offer valuable perspectives on public space design, it is crucial to recognize the specific contexts where each method excels. In densely populated or small-scale environments, where the nuances of pedestrian interactions and local spatial characteristics are critical, axial line analysis may offer less detailed insights. Its strength lies in analyzing larger urban settings, effectively capturing citywide or neighborhood-scale connectivity and movement patterns. Therefore, selecting between visibility and axial line analysis should be guided by the scale and specific characteristics of the public space under study. Aligning the analytical method with the research goals and the environment's scale is essential for obtaining meaningful and actionable insights.



[18] Overlap of axial line analysis with visibility analysis.

5.1.4. Overlap of Axial Line Analysis with Visibility Analysis

When overlaying visibility results with axial line analysis, focusing on L1, the most integrated line, and L2, the most connected line, a significant alignment between these spatial attributes emerges, as illustrated in Figure [18].

L1, stretching across the park and connecting multiple areas, reinforces its role in unifying the park's spatial layout. Its overlap with highly visible areas suggests that L1 not only facilitates movement but also enhances visual coherence. Similarly, L2, the most connected line, intersects several high-visibility zones, emphasizing its importance in linking various nodes within the park and connecting it with the surrounding urban environment.

The overlap yields several key insights:

- **Centrality of Key Routes**: The intersection of high-visibility zones with L1 and L2 underscores these lines as central pathways. They are more than connectors; they serve as primary routes that support both movement and visual interaction, making them crucial to the park's spatial structure.
- **Correlation Between Visibility and Connectivity**: The alignment of high-visibility red zones with L1 and L2 axial lines indicates a strong correlation between visual accessibility and spatial integration, with L1 playing a vital role in guiding movement and enhancing the visual experience.
- **Enhanced Understanding of Spatial Dynamics**: The combined analysis provides a deeper understanding of how people navigate and perceive the park. The integration of high-visibility zones with key axial lines highlights areas central to pedestrian movement and visually connected, contributing to a more cohesive and accessible public space.

These findings highlight the value of integrating axial line analysis with visibility analysis to understand the interplay between spatial configuration and visual accessibility. Overlapping areas should be prioritized in future design and management efforts to enhance both the functional and perceptual qualities of the park.

[19] Isovist analysis result: (A) the space is visible, except for the inner subspace, due to the visual obstructions, (B) partial visibility can also be noticed from the generating point, (C) visible from the inner center of subspace.

5.1.5. Space Syntax: Isovist analysis

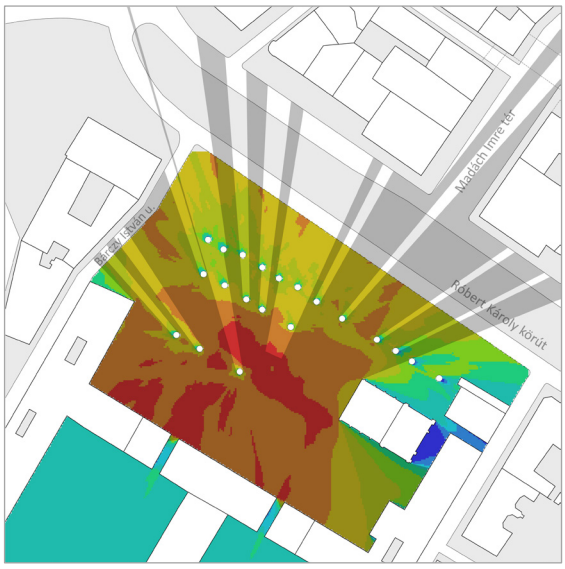
In this analysis, isovists are generated from strategically selected points at the intersection nodes of red axial lines identified earlier as having higher integration levels. These key points, located within subspaces 1 and 2, are typically associated with entrances or access points from the Boulevard, where spatial integration is strongest and visual connections are more pronounced. By generating isovists from these points, analysts can compare the visual potential of these entry locations as experienced by users, providing a deeper understanding of how these areas function as visual attractors and contribute to the overall user experience within the space.

The isovist analysis reveals that in Figure [19] (A), the space surrounding the key entry points is largely visible, except for certain areas within the inner subspace where visual obstructions such as trees limit visibility. Figure [19] (B) shows partial visibility from the generating points, indicating that while some areas are well-integrated into the visual field, others remain partially hidden. Figure [19] (C) highlights how visibility varies across different sections of the park, with the inner center of the subspace remaining visible from within.

Additionally, isovists generated from points within the more segregated inner subspace, which has limited visual connections to the surrounding space, contrast with those from the more integrated entry points. This analysis highlights differences in visual potential between segregated and integrated areas within the same spatial configuration.

The key findings emphasize the role of visibility in shaping the user experience. High-visibility areas around key entry points enhance wayfinding and create a welcoming atmosphere, making these zones central to user interaction and movement. In contrast, the inner subspaces, with their limited visibility, may lead to a sense of enclosure or underutilization. This contrast between visually open and segregated zones illustrates how visual connectivity influences user behavior, with areas of strong integration more likely to attract foot traffic and encourage exploration.

Isovist analysis primarily considers the geometric shape of the visual field from each observation point, offering insights into visibility, visual connections, and the perceptual experience of users. This approach is a valuable tool for understanding the spatial characteristics that influence user behavior, wayfinding, and the overall functionality of an environment.



[20] Overlap of visibility analysis with isovist analysis from the inner center of subspace.

5.1.6. Overlap of Visibility Analysis with Isovist Analysis from the Inner Center of Subspace

The isovists limited visual reach, when compared with the broader visibility analysis, illustrates how these inner subspaces might feel more isolated and less connected to the rest of the park, as illustrated in Figure [20]. This alignment suggests that the inner subspace could be perceived as less accessible and inviting, potentially impacting user movement and behavior within the park. The overlap of these analyses yields several important insights:

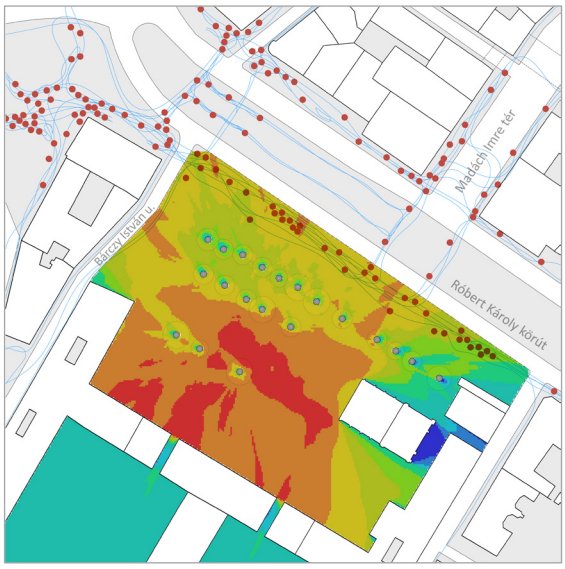
- **Segregation and Isolation of Inner Spaces**: The limited overlap between high-visibility zones and the isovist from the inner center emphasizes the segregation of these inner spaces. This suggests that users within these areas may experience a sense of enclosure or isolation, which could discourage exploration and reduce overall usage of these zones.
- **Impact on User Behavior and Experience**: The contrast between the visibility of integrated areas and the confined isovist from the inner subspace highlights how visual barriers influence user perception and movement. Areas with limited visibility may be perceived as less navigable, affecting how users engage with these parts of the park.
- **Design Implications for Enhanced Connectivity**: This analysis reveals potential opportunities for design interventions aimed at improving visual connectivity within the park. By addressing the visual isolation of the inner subspaces, it may be possible to enhance the overall cohesion and accessibility of the park, making these areas more inviting and integrated with the rest of the space.

These findings demonstrate the importance of considering both visibility and isovist analyses to fully understand the spatial dynamics of public spaces. The overlap between these two analyses highlights areas where visual connectivity could be improved to enhance the functional and perceptual qualities of Városháza Park.

Thesis 4 - Enhancing Public Space Functionality Through Integrated Spatial Analysis

Integrating visibility analysis with spatial configuration techniques, such as isovist and axial line analysis, is essential for optimizing the functionality and user experience of public spaces. This approach systematically examines how visual connections and spatial layouts influence movement patterns and user behavior, offering critical insights into the design and management of public areas. Visibility analysis reveals how visual barriers like trees impact accessibility and movement within a park, while isovist analysis highlights areas of visual integration or isolation, directly affecting user engagement.

These methods demonstrate that spaces with high visual connectivity are perceived as more accessible and inviting, thereby encouraging greater interaction and use. In contrast, areas with reduced visibility or visual segregation tend to be underutilized, as they may feel enclosed or disconnected from the rest of the space. Addressing these disparities through informed design interventions can enhance the cohesion, accessibility, and attractiveness of public spaces, ultimately contributing to more effective and user-friendly urban environments.



[21] The overlapping of the behavior map with the visibility graph, a correlation between integration values and space occupancy.

5.1.7. Overlapping Behavior Map and Visual Integration Map

The overlapping of the behavior map with the visibility graph reveals a significant correlation between the integration value and the occupancy of space [Figure 21]. This finding aligns with Hillier and Hanson's (1984) theory that spatial integration, as determined through space syntax analysis, significantly influences how spaces are utilized. The analysis shows that areas with higher integration values, which correspond to better visual accessibility and connectivity, tend to attract more users. These areas, being the most visible and accessible within the space, naturally draw people to occupy them. This relationship suggests that human behavior in selecting locations for specific activities is closely tied to the spatial syntactic properties of the environment, as supported by Gehl's (2011) observations on urban space usage. Visual access and visibility emerge as critical factors that influence how people move through and choose spaces for their activities; the more visually accessible an area, the more likely it is to be actively used by the public.

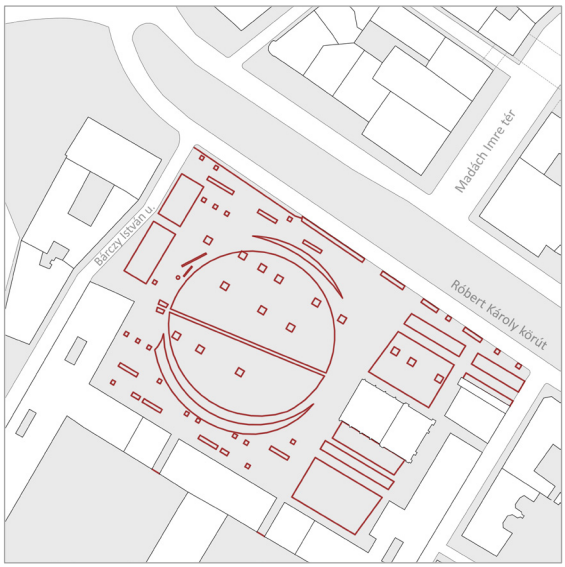
A closer examination of the Figure [21] reveals several key insights regarding the spatial dynamics of Városháza Park, particularly at the central entrance from Károly Boulevard, which connects to Madách Imre Square. The red areas identified at this entrance indicate zones of high integration and visibility, suggesting that these areas are both visually prominent and well-connected within the park's spatial network. The connection to the street crossing zebras further reinforces this, as these crossings are critical points for pedestrian movement, linking the park directly to the surrounding urban fabric. The higher integration value at this entrance likely contributes to increased foot traffic, making it a focal point for people entering the park.

In contrast, the pedestrian sidewalks along the edge of the site, which are marked in yellow, exhibit lower integration values. These areas, with less visibility and connectivity, are less likely to attract significant pedestrian movement compared to the more integrated central entrance. This disparity highlights the impact of spatial integration on user behavior, where areas with lower integration values tend to be less frequented, potentially due to their reduced visual accessibility and weaker connections to the overall pedestrian network.

Additionally, the red areas along the edge of Bárczy István Street present an interesting contrast. Despite their high integration value, these areas experience less pedestrian flow compared to the central entrance. This could be due to several factors: the physical design of the space, potential visual barriers, or the lack of direct connections to major pedestrian routes or attractive destinations. The lower user flow in these highly integrated but underutilized areas suggests that while spatial integration is a critical factor, it must be complemented by other elements such as accessibility, destination attractiveness, and the quality of the urban environment to effectively draw people into the space.

Despite its favorable location within the urban structure, the layout of Városháza Park does not fully capitalize on key spatial parameters due to several visual obstructions between subspaces. As Whyte (1980) observed, visual barriers such as trees and poorly placed urban elements can significantly disrupt user movement and diminish the vibrancy of public spaces. In Városháza Park, the placement of trees, the location of parking lots that act as visual shields, and the suboptimal quality of urban furniture (Carmona, Heath, Oc, & Tiesdell, 2010) contribute to these issues, weakening the park's spatial integration and reducing its functionality, despite its good connectivity within the broader urban fabric.

This analysis reveals that while high integration and visibility are crucial for encouraging pedestrian movement, other factors, such as design quality and connectivity to desirable destinations, also play a key role in determining usage patterns. These findings underscore the need to consider both visual integration and spatial layout in public space design to create areas that are accessible, inviting, and functional for users.



[22] Schematic layout of the Design A.

[23] Schematic layout of the Design B.

5.2. IMPLEMENTATION OF THE PROPOSED DESIGNS

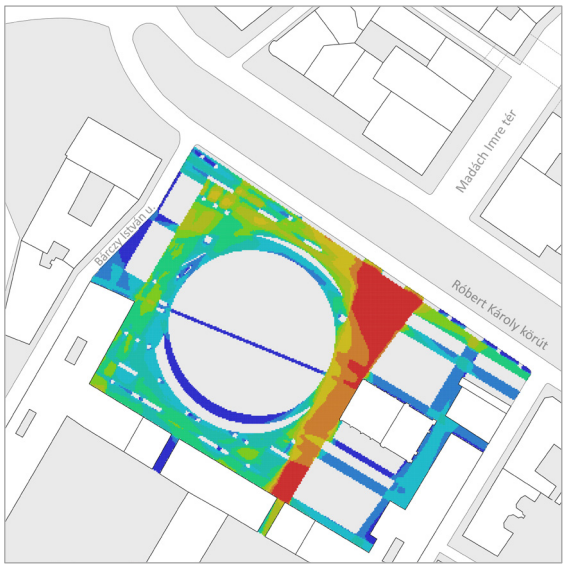
In this phase, the analysis of the selected case studies begins with the extraction of lines from the proposed plans and the creation of simplified site plans, as illustrated in Figures [22] and [23]. This process involves detailing pedestrian sidewalks, green spaces, and borders, resulting in a clear visual representation of the existing designs. With this spatial foundation in place, further analysis is conducted to examine the spatial characteristics within the studied public spaces.

The analysis then focuses on key spatial principles such as visibility, connectivity, and integration, providing insights into the strengths and areas for improvement in the existing designs. These insights guide strategic modifications aimed at enhancing the studied public spaces. The verification phase assesses how well these changes align with both analytical insights and the practical needs of the public space. This process illustrates the dynamic interaction between initial spatial analysis and the analysis performed with the proposed designs in mind, highlighting a holistic approach from spatial analysis to design adjustments and final verification.

The objective is to evaluate the layout proposal, assessing whether the spatial properties of different subspaces align with the functional principles of the design. This is done through three analyses using DepthmapX (Space Syntax Lab, UCL): Visibility Graph Analysis (VGA), fewest-lines analysis, and isovist analysis.

According to the VGA results, the most integrated spaces are in the east, transformed into an esplanade with a memorial wall designed to maintain visibility and create a wide, open area that draws people into the park. In more segregated areas, a cultural space will be developed as an extension of the city hall, alongside a green space with trees, forming a small garden for rest and relaxation, offering users seclusion.

To address areas with partial visibility identified in the analysis, the center of the park will feature an outdoor theater and fountain, creating a dynamic gathering point visually connected to all park subspaces, effectively countering the ‘edge effect’ that can influence space usage.



[24] Visual integration values (VGA) of the Design A.

[25] Visual integration values (VGA) of the Design B.

5.2.1. Visibility analysis of the proposed designs

At this part of the analysis, the visibility analysis is verified through the examination of Visual Step Depth within two proposed design variations, as illustrated in Figures [24] and [25]. Space syntax and visibility analysis are utilized to understand how different design elements impact visual integration and connectivity across Városháza Park.

Design A features a circular central part, with key findings from the Visual Step Depth analysis revealing significant variations in visibility:

- The corridor leading from Madách Imre Square is highlighted in red, indicating very high visibility and integration, suggesting it will serve as a primary pedestrian route. The high Visual Step Depth along the lower edge near Merlin and Madách Imre Street also enhances visibility, offering expansive vistas and extended visual coverage within the park.
- Areas near Bárczy István Street appear in green, showing low to moderate visibility and integration—less than the central corridor but still relatively connected. This suggests a moderate level of interaction, though these areas may see less traffic due to their lower visibility.
- Areas adjacent to Károly Boulevard mostly show green tones, with some parts near the red corridor displaying yellow to orange hues, indicating moderate to high visibility and integration. While less integrated than the central path, these zones maintain decent visibility and accessibility, likely ensuring moderate use.
- Notably, areas behind the Merlin Theater are shown in blue to dark green, indicating very low visibility and integration. These secluded areas may see less frequent use due to their lower visibility, making them suitable for functions requiring more privacy. The lower Visual Step Depth here and along the edges connected to the town hall suggests a potential separation that could impact connectivity between these spaces and the park.

Design B presents a different spatial configuration, with distinct patterns observed in the Visual Step Depth analysis:

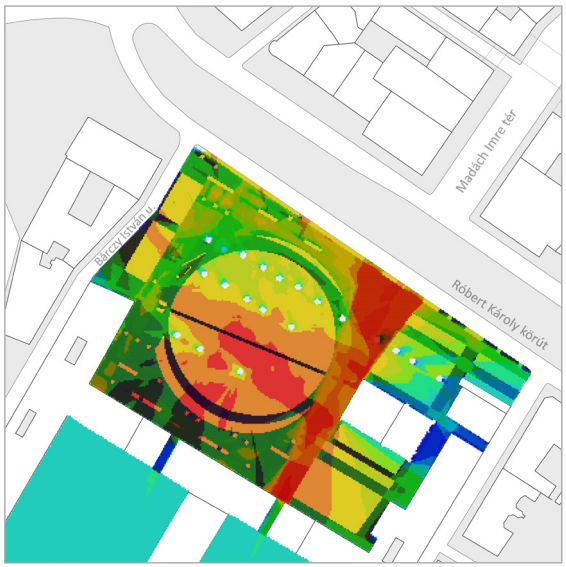
- Both main corridors in this design are predominantly light green, with areas closer to yellow, suggesting moderate visibility and integration along these pathways, supporting steady but less intense pedestrian flow compared to Design A's central corridor. This level of visibility allows for adequate movement and interaction, but without the dominance seen in the central corridor of Design A.
- At the beginning of these corridors, particularly at their connections to Károly Boulevard and Madách Imre Square, the areas are highlighted in red, indicating very high visibility and integration. This likely encourages people to enter the park and follow these routes, making these entry points significant attractors for pedestrian traffic.
- The corridor connections at the entrance to the building at the end of these pathways are also highlighted in red, signifying very high visibility and integration at these key points, suggesting they will be significant attractors within the park, drawing users toward the building and facilitating interactions or gatherings.
- The remaining areas of Design B predominantly feature yellow to green tones, representing moderate to low visibility and integration. These areas are sufficiently integrated to support regular pedestrian activity but are less visually connected than the red-highlighted corridors, ensuring a balance between open and more secluded spaces.
- Behind the newly designated trees and in the narrower corridor, the analysis shows blue areas, indicating very low visibility and integration. These spaces are more segregated, making them suitable for functions that benefit from a quieter, more secluded atmosphere, such as seating areas or benches designed for relaxation. This shift in visual accessibility is particularly noted as the walkways approach the edges where they are divided by a row of trees, with inner areas becoming more secluded and visually separated from the main flow of pedestrian movement.

Summary of Findings:

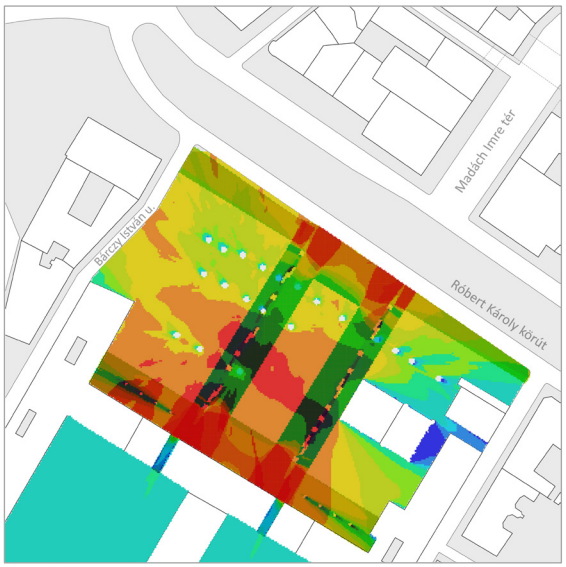
The comparison between the two designs reveals important insights into how different spatial configurations impact visibility and, consequently, user behavior within the park.

Design A emphasizes a strong central corridor with very high visibility, making it the dominant pathway for movement and interaction. The enhanced visibility along the lower edge and in front of Madách Imre Street further strengthens these areas as key zones of interaction. However, this design also features areas of significant visual segregation, particularly behind the Merlin Theater and along the edges near the town hall, which might be underutilized or reserved for more private activities.

Design B offers a more balanced distribution of visibility, with very high visibility at both the entry points and along the main corridors. The presence of segregated spaces behind the trees and in the narrower corridors provides opportunities for designated activities that require more privacy, such as seating or quiet areas. The moderate visibility throughout most of the park ensures that these spaces remain connected yet distinct, catering to diverse user needs.



[26] Overlapping visibility analysis of the existing layout with the Design A.



[27] Overlapping visibility analysis of the existing layout with the Design B.

5.2.2. Verification of Spatial Integration

Comparative Overlapping of Visibility Analyses

The overlapping of visibility analysis figures from the current conditions and the proposed designs, as illustrated in Figures [26] and [27], provides a comprehensive understanding of how the proposed design interventions impact the spatial and visual integration within Városháza Park. By layering the results from the initial visibility analysis of the park's existing layout with the visual integration analyses of the proposed designs, we can verify the effectiveness of these design changes in enhancing or diminishing user experience, connectivity, and spatial coherence.

Central Corridor and Visual Connectivity:

The overlapping analysis reveals that the central corridor in both proposed designs (particularly in Design A) retains its significance as a highly integrated and visually accessible pathway, as previously identified in the original visibility analysis. This corridor, which runs from Madách Imre Square through the park, consistently appears in red across all visual integration maps, indicating that it remains a primary route for pedestrian movement. The design interventions in this area have successfully maintained or even enhanced its visibility, ensuring that it continues to serve as a key artery within the park.

The additional analysis of Design A shows that areas along the lower edge of the park, particularly near Merlin, also exhibit high visibility. These areas are integral to maintaining visual connectivity across the park, as they allow for expansive views and minimal visual obstructions, reinforcing their role as spaces that draw users deeper into the park [Figure 26].

In Design B, while the central corridor also remains a significant pathway, the visual connectivity is slightly more balanced across the park, with a more even distribution of visibility. The overlapping maps show that while the visibility is not as dominant as in Design A, it still ensures that multiple entry points and pathways are accessible and connected. This approach caters to a broader range of users and activities, encouraging movement throughout the park [Figure 27].

Visual Segregation and Edge Effects:

The analysis highlights a critical observation regarding visual segregation, particularly in areas behind the Merlin Theater and near the town hall. In both the original and proposed design analyses, these areas consistently appear in blue or dark green, indicating very low to low visibility and integration. The overlapping maps confirm that despite the design interventions, these zones remain visually segregated from the more integrated and accessible parts of the park.

For Design A, the persistence of low visibility in these areas suggests that the design has not sufficiently addressed the visual disconnect between the central park spaces and the town hall or the Merlin Theater. The potential for these areas to be underutilized remains high, as users are less likely to be drawn to spaces that are visually isolated from the main flow of activity.

Design B, while also showing low visibility in these regions, attempts to balance this by creating designated spaces for more private or secluded activities. The addition of trees and seating in the blue areas indicates a deliberate design choice to provide quieter, less trafficked zones. However, the overlapping maps suggest that while these spaces may cater to specific needs, their segregation from the central pathways could limit their overall usage.

Moreover, the confrontation of the visibility analysis results of Városháza Park with the design proposals shows that the most integrated and connected spaces in the existing layout align closely with those in the proposed designs, but with a notable enlargement in the integrated areas. This suggests that the design interventions have successfully expanded the highly integrated zones, making the park more cohesive overall. Additionally, most of the previously segregated spaces in the current layout have disappeared in the proposed designs, becoming more connected with all subspaces. This is particularly evident in Design B, where the distribution of visibility is more balanced, and the integration between different areas of the park is enhanced.

Impact of Design Elements on Visual Integration:

The overlapping analysis emphasizes the significant role that design elements such as trees, pathways, and urban furniture play in shaping visual integration within the park. The introduction of new pathways and landmarks, such as the memorial wall and the footbridge in the eastern part of the park, has enhanced visibility and accessibility in these areas, as shown in the overlapping maps. These elements have successfully transformed previously less integrated spaces into key visual and functional nodes within the park.

The visibility analysis also reveals that the visual field (isovist) generated from the same points in both the existing layout and the proposed designs is more expansive in the proposed designs, indicating deeper and broader views. This enhancement in visibility suggests that the proposed design has achieved a higher level of visual integration, with all subspaces interconnected within the park and with the surrounding urban environment. However, the western zone next to the city hall retains some level of visual segregation, which may be beneficial, as literature indicates that people often prefer occupying edges to maintain views while preserving privacy, a preference the current design successfully accommodates.

However, the overlapping analysis also reveals potential drawbacks. For instance, the row of trees introduced in both designs, particularly in Design B, while providing shade and aesthetic value, also contributes to a reduction in visual connectivity in certain corridors. The color shifts to blue in these areas indicate a higher level of segregation, which, while intentional, could impact user movement and experience. The overlapping maps thus serve as a verification tool, confirming that while these design choices meet certain functional needs, they also introduce new challenges in maintaining overall spatial integration.

Enhancing User Experience Through Balanced Design:

The overlapping analysis ultimately verifies that both proposed designs have made strides in improving the visual integration of Városháza Park, but each with different strengths and weaknesses. Design A's strong central corridor and enhanced visibility along the lower edge offer a clear and dominant pathway, but the persistence of visual segregation near the Merlin Theater and town hall suggests areas for further improvement.

Design B, with its more balanced distribution of visibility, caters to a wider range of activities and user experiences, ensuring that the park remains accessible and inviting from multiple entry points. However, the trade-off between creating secluded spaces and maintaining overall connectivity is evident in the overlapping maps, indicating a need for careful consideration in how these spaces are utilized and integrated.

5.2.3. Evaluating the Gate-count model

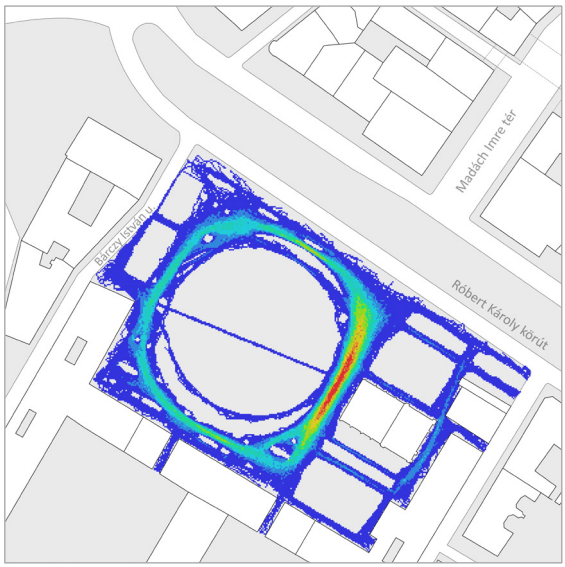
The gate-count model generated as part of this analysis serves as a predictive tool, offering valuable insights into anticipated pedestrian flow within Városháza Park. By visualizing how people are expected to move through the space, the model reveals the impact of design choices, particularly the introduction of visual barriers and pathways, on movement patterns and overall spatial dynamics.

Design A [Figure 28], shows a clear relationship between visibility and pedestrian flow. The central corridor, prominently highlighted in red in both the visibility analysis and gate-count model, emerges as the main artery of movement within the park. This area, which includes the circular central design, attracts significant pedestrian activity, with green areas surrounding the circle indicating moderate flow, and yellow zones connecting the circle to Károly Boulevard, signaling effective connectivity. However, peripheral areas marked in blue suggest lower levels of pedestrian activity, likely due to their reduced visibility and integration within the overall design.

Design B [Figure 29], presents a more balanced distribution of pedestrian flow. The two main corridors are marked in yellow, indicating steady movement that aligns with the moderate visibility levels observed in the visibility analysis. The sidewalks along Károly Boulevard also show significant pedestrian activity, underscoring their importance in connecting the park to the surrounding urban fabric. The presence of red areas in the central portions of both corridors and at their endpoints near the building entrance suggests these locations are likely to become focal points for pedestrian interaction. Meanwhile, light blue areas in the narrower corridors indicate lower movement, reflecting their more secluded nature, which may be intentional for creating quieter, more private spaces.

Key Observations:

- **Design A**: The strong alignment between the red areas in the gate-count model and the high-visibility corridors confirms that this design encourages concentrated pedestrian movement along these key routes. However, the blue areas suggest that certain parts of the park may remain underutilized, potentially due to lower visibility and less direct connectivity.
- **Design B**: The more evenly distributed pedestrian flow, with yellow corridors and red focal points, indicates a design that promotes movement across multiple pathways while still maintaining specific areas of high activity. The integration of these pathways with the broader urban context, particularly along Károly Boulevard, appears successful.



[28] Gate-count model: Early representation of pedestrian flow in the Design A.

[29] Gate-count model: Early representation of pedestrian flow in the Design B.

Importantly, the analysis does not indicate that one design is inherently better than the other. Instead, these findings highlight how each design aligns with different aspects of urban design priorities. For example, Design A might be more suitable for scenarios where the goal is to create a dynamic central hub of activity, which aligns with Jan Gehl's essential quality of Vitality, ensuring a space that fosters active engagement and interaction. Conversely, Design B offers a design that supports a broader distribution of movement, potentially aligning better with Gehl's principles of Permeability and Comfort, where the focus is on creating a more accessible and comfortable experience for a diverse range of users throughout the park.

These insights underscore the importance of aligning design choices with the specific needs and desires of the community and the objectives of the designer. Whether the focus is on creating vibrant, high-traffic areas or ensuring comfortable, accessible spaces for varied activities, both designs offer valid solutions that can be optimized based on the context of their implementation.

Thesis 5 - Verifying Spatial Integration Through Overlapping Analysis

Verifying spatial integration through the overlapping of visibility analysis provides crucial insights into how proposed design interventions impact the connectivity and functionality of public spaces. This method allows for a comprehensive assessment of how visual and spatial modifications influence user experience and movement patterns within the environment. In the case of Városháza Park, the overlapping of visibility analysis between the current layout and proposed designs reveals how central corridors and key pathways are maintained or enhanced, ensuring that these spaces remain accessible and inviting to the public.

The overlapping analysis highlights areas where design interventions have successfully expanded visually integrated zones, making the park more cohesive and interconnected. However, it also identifies persistent areas of visual segregation, where low visibility may continue to impact user engagement. By layering visibility data, the analysis confirms which design elements enhance or detract from the park's overall spatial integration, providing a validated approach for optimizing public space layouts to better support user needs and urban functionality. This method underscores the importance of continuous verification in the design process to ensure that public spaces remain functional, accessible, and aligned with both theoretical goals and practical use.

6. CONCLUSION

This research has systematically explored the pivotal role that spatial configuration plays in determining the functionality and user engagement within urban public spaces. Focusing on Városháza Park in Budapest, this study employed space syntax as its primary analytical tool, complemented by behavioral mapping techniques, to investigate how the physical layout of public spaces influences pedestrian movement, social interactions, and overall user experience. To verify and answer the research questions outlined earlier, the study addressed the following points:

Research Question 1: What is the potential impact of an additional evaluation stage between design and implementation on the effectiveness of public space designs?

The additional evaluation stage between design and implementation, particularly when utilizing space syntax analysis, has a significant positive impact on the effectiveness of public space designs. This phase allows for a detailed assessment of spatial configurations, identifying potential issues related to visibility, connectivity, and user engagement before finalizing the design. By addressing these factors early, the evaluation stage ensures that public spaces are more functional, accessible, and aligned with human-scale needs. The inclusion of this stage helps to refine design elements, reduce the likelihood of costly post-implementation adjustments, and ultimately leads to public spaces that are better integrated within the urban fabric and more responsive to the behaviors and needs of their users. This approach fosters more sustainable and successful public space projects, enhancing their overall contribution to the urban environment.

Research Question 2: In what ways do spatial configurations, correlate with observed pedestrian behaviors and usage patterns?

The findings from this study clearly show a correlation between spatial configurations, as analyzed through space syntax, and observed pedestrian behaviors and usage patterns. Areas within Városháza Park identified through space syntax analysis as having high integration and connectivity values consistently attracted the most pedestrian activity, as confirmed by behavior mapping. This correlation highlights the critical role of spatial design in influencing how people use public spaces. The research also showed that while well-integrated areas encourage movement and social interaction, segregated areas tend to be less frequented, often used for more solitary or specialized activities. These insights reinforce the concept that effective urban design must consider both the physical structure and the social dynamics of space to enhance overall usability.

Research Question 3: What specific recommendations can be derived from the integrated analysis to improve the design and planning of public spaces to better support walkability and public life?

The examination of the proposed design variations for Városháza Park provided recommendations for improving public space design to better support walkability and public life. The first design, with its emphasis on a central corridor exhibiting high integration, was identified as a strong candidate for fostering vibrant pedestrian movement. However, it also presented challenges related to the segregation of certain areas, which could potentially limit their use to more private or less active functions. The second design offered a more balanced spatial configuration, supporting diverse activities and user experiences across multiple corridors.

The study highlights the importance of aligning design strategies with the specific needs and goals of the community, ensuring that public spaces are walkable, accessible, and conducive to social interaction.

Additionally, the research emphasizes the importance of considering visual and spatial relationships between different areas within a public space. Clear sightlines and visual connections to surrounding spaces were found to be crucial in attracting and sustaining pedestrian activity. This suggests that future designs should prioritize physical and perceptual accessibility to create environments that are welcoming and easy to navigate.

Final Conclusion:

This research has significantly contributed to urban design by demonstrating the direct impact of spatial configuration on walkability and overall functionality in public spaces. Through the application of space syntax analysis and behavioral mapping, the study provided a robust framework for understanding and optimizing spatial arrangements that enhance pedestrian movement and social interaction. The findings emphasize that there is no universal solution in public space design; instead, effective designs must be tailored to the specific needs and characteristics of each urban context.

A critical aspect highlighted in this research is the stage between design and implementation. By analyzing the designs submitted in the architectural competition for Városháza Park, the study aimed to ensure that these designs fully met the space's requirements. This intermediate stage is crucial, as it allows for a careful examination of whether the proposed designs are both conceptually sound and practically feasible. This step ensures a smooth transition from design to execution and that the final outcome effectively addresses the real needs of the space and its users. The findings underscore the importance of this intermediate stage in urban design projects, where theoretical insights are translated into practical, actionable solutions.

The study also underscores the value of integrating quantitative and qualitative methods in urban design research, emphasizing the importance of creating spaces that are functionally efficient, engaging, and responsive to users' needs. While space syntax offers powerful tools for analyzing spatial configuration, incorporating behavioral and observational methods enriches our understanding of how these spaces are utilized. This combined approach leads to more informed and effective design decisions, offering practical recommendations for achieving a balance that supports walkability, accessibility, and vibrant urban environments.

Moreover, the research acknowledges the limitations of space syntax, particularly in its two-dimensional analysis, and suggests that future studies could benefit from incorporating three-dimensional modeling and other advanced techniques to provide a more comprehensive view of spatial dynamics. By continuing to refine these methods and expand our understanding of spatial configuration, urban designers can contribute to creating cities that are truly designed for people.

To further validate the findings and recommendations presented in this study, the design principles and strategies discussed can be evaluated against the ‘Public Space Design Objectives’ outlined in Appendix 1. This future evaluation will help confirm whether the proposed designs align with the broader objectives of creating accessible, engaging, and well-integrated public spaces.

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APPENDIX 1

PUBLIC SPACE DESIGN OBJECTIVES

Public spaces are the heartbeats of cities, where diverse communities converge, and social life thrives (Carr, Francis, Rivlin, & Stone, 1992). They play a pivotal role in shaping the urban experience and fostering a sense of belonging. To harness the full potential of public spaces and ensure their functionality, attractiveness, and inclusivity, it is essential to establish clear design objectives.

These design objectives are guided by foundational urban design principles that ensure spaces are functional, aesthetically pleasing, and significantly contribute to community well-being (Praliya & Garg, 2019). Public areas, such as parks, plazas, and streets, are key elements of the urban landscape, offering venues for recreation, social interaction, and community activities (Galimberti, 2020). The design and planning of these spaces must be context-sensitive, enhancing areas of community value while creating safe, healthy, and enjoyable environments. Essential considerations include the location, dimensions, integration with surrounding properties, and the design of pathways and activity zones. The interaction between these areas and the broader pedestrian network is vital for fostering accessibility and inclusivity (Praliya & Garg, 2019).

These objectives also align with global initiatives such as the UN Sustainable Development Goal 11.7, which aims to "*provide universal access to safe, inclusive, and accessible green and public spaces*" by 2030 (Galimberti, 2020). These goals guide the creation and enhancement of public spaces and local parks while also serving as a benchmark for evaluating existing and proposed designs. By clearly defining these objectives, urban planners, architects, and designers can develop vibrant and inviting urban environments that align with community needs and aspirations.

Moreover, these objectives are essential for verifying whether the design and analysis of public spaces align with the intended outcomes. As the study progresses, these objectives will be referenced to assess whether the proposed designs effectively incorporate the principles of functionality, attractiveness, and inclusivity. This approach ensures that the spaces meet aesthetic and practical criteria while supporting the social and cultural dynamics of the urban environment. Adhering to these guidelines enables urban planners and designers to align their work with best practices, contributing to the broader goal of creating vibrant, inclusive, and sustainable urban environments (Galimberti, 2020).

I. Accessibility: Ensuring that all users have convenient and safe access to and through public spaces

A fundamental principle of public space design, aligned with Jan Gehl's "priority for people" (Gehl, 2010), is equitable access. This principle ensures that public spaces are accessible to all community members, regardless of age, abilities, or socio-economic background. Accessibility includes ease of entry and the integration of essential services and amenities that enhance usability and appeal. Safety is also critical, ensuring that safe passage through public spaces is a fundamental right for everyone (Carmona, Heath, Oc, & Tiesdell, 2010).

Key points:

- Connect the public space to the surrounding pedestrian network: Pathways should seamlessly link with the urban fabric, facilitating easy movement into and through the space.
- Position entrances on pedestrian desire lines: Utilize natural paths for park entrances, making them intuitive and convenient (Gehl, 2010).
- Provide direct, clear sightlines from surrounding areas to public spaces: Ensure that topography and design elements support clear visibility into and throughout the public space.
- Create perimeter paths: Facilitate walking and jogging with continuous paths around the park's edges.
- Subtle transitions between public and private spaces: Use Define boundaries using low fences, ground level changes, or landscaping without high barriers.
- Accessible and well-signposted services: Integrate amenities like restrooms, seating, and drinking fountains to enhance usability.

II. Comfort: Ensuring comfortable and enjoyable public spaces

Public spaces should be places of respite, relaxation, and social interaction. Comfort, as emphasized by urban design experts like Jan Gehl, is crucial to making these spaces inviting and well-utilized. This involves providing a range of seating options, adequate shade, shelter from elements, and thoughtful consideration of microclimatic factors to create an environment where people want to linger and engage in various activities (Whyte, 1980).

Key points:

- Ample seating options: Offer a variety of seating choices like benches, steps, and low walls to cater to different preferences, especially in areas with good sightlines.
- Accessibility for all: Design spaces to be accessible, incorporating ramps, wide paths, and tactile paving to enhance comfort and ease of access.
- Optimize microclimate: Arrange pathways and seating to maximize sun exposure in winter and shade in summer, positioning trees and structures to enhance comfort.
- Wind protection: Design spaces to minimize wind exposure while avoiding concealment opportunities that could compromise safety.
- Visual engagement: Place seating near interesting views or focal points to encourage people to stay and engage with their surroundings.

III. Enjoyment: Achieving attractive and vibrant public spaces

The aesthetic and sensory qualities of public spaces significantly impact their use and appeal. Vibrant public spaces, as Jan Gehl emphasizes in 'Cities for People' (2010), stimulate the senses and encourage interaction. They become destinations that draw people in and foster a sense of community. Designing for attractiveness is not merely an aesthetic endeavor; it's a strategy to bring people together and foster a sense of pride in the community (Whyte, 1980).

Key points:

- Programmatic Diversity: Offer a variety of activities and amenities within the public space. This could include cafes, playgrounds, performance spaces, designated areas for markets, or spaces for community events. Catering to a wide range of interests and age groups encourages people to linger in the space, fostering a sense of liveliness and engagement.
- Focal Points and Landmarks: Create focal points or landmarks within the space to attract people and serve as gathering places. These elements could be sculptures, fountains, water features, unique landscaping features, or performance spaces. Focal points add visual interest, provide a sense of orientation, and encourage interaction.
- Places for Vendors: Allocate designated spaces for vendor stalls adjacent to high-traffic pedestrian walkways. This approach provides economic opportunities for local vendors while adding vibrancy and activity to the public space. The sights, sounds, and energy generated by vendors help to activate the space, drawing people in and enhancing the overall experience.

IV. Sociability: Establishing and supporting activities at the edges of public spaces

The edges of public spaces are often the most populated and socially vibrant areas. These edges naturally attract attention, providing excellent vantage points for viewing activities both within the space and in the surrounding areas. They serve as stages for a wide array of activities, from street performances and markets to outdoor dining and community gatherings. Designing to facilitate these edge activities enhances the vitality and dynamism of public spaces, making them more inviting and socially engaging (Gehl, 2010).

Key points:

- Building views: Spaces feel safer and are more used when nearby buildings have windows and doors overlooking them, enhancing security and community connection.
- Informal seating: Low walls, benches, and seating along edges encourage social interaction, serving as gathering spots that add vibrancy to the space.
- Clear sightlines: Ensure unobstructed visibility into and through public spaces for safety and ease of movement, using thoughtful placement of trees and structures.
- Subtle boundaries: Use changes in ground level, low fences, or landscaping to define boundaries between public and private spaces without creating isolating barriers.

V. Safety: Ensuring safety and amenity in public spaces

A safe and comfortable environment is paramount for public spaces to thrive. The objective of safety extends beyond physical security to include psychological comfort. It encompasses well-lit spaces, clear sightlines, and measures that promote a sense of security among users (Carmona, Heath, Oc, & Tiesdell, 2010).

Key points:

- Well-lit pathways: Ensure lighting is consistent with surrounding streets, especially for nighttime use, to enhance user safety.
- Clear sightlines: Maintain visibility between park paths and surrounding streets to deter criminal activity and create a safer environment (Gehl, 2010).
- Active frontage: Border parks with streets and buildings that overlook them to increase informal surveillance and reduce crime.
- Visible locations: Position paths, facilities, and play areas where they are easily visible from nearby homes and streets to increase safety and usage.
- Low fences around play areas: Use low, transparent fences to protect children while maintaining visibility from surrounding areas, ensuring safety without isolation.
- Active placement of amenities: Position amenities in well-trafficked areas to encourage use and enhance safety, avoiding secluded locations that might discourage use (Gehl, 2010).

VI. Uses and Activities: Supporting a strong sense of place and local character in public spaces

Public spaces should embody the unique identity of the communities they serve, reflecting the culture, history, and aspirations of the local population. This principle ensures that public spaces are not generic but are instead integral components of the local fabric, creating a sense of place that resonates with both residents and visitors (Cresswell, 2013). In addition to enhancing the local character, these spaces should be designed to support a wide range of activities, fostering engagement and interaction within the community.

Key points:

- Incorporate local culture: Integrate locally relevant art, architecture, and cultural symbols to enhance visual appeal and deepen the community's connection to the space.
- Support local character with plantings: Use native or characteristic plant species and landscaping features to reinforce the area's identity and contribute to ecological sustainability.
- Enhance microclimate and habitat: Plant large trees and vegetation to improve the microclimate, provide shade, and support local biodiversity, enhancing comfort and environmental connection.
- Engage the senses: Use plantings and landscape elements that stimulate the senses, such as fragrant flowers and textured surfaces, to create a more inviting and memorable space.
- Preserve natural features: Highlight distinctive natural elements like streams, rock formations, or mature trees to anchor the space within its natural context and strengthen the sense of place.

VII. Permeability: Promoting fluid movement and connectivity

Permeability in urban design ensures that public spaces are well-connected, accessible, and open, fostering interaction, encouraging walking, and enhancing the vibrancy of public areas (Carmona, Heath, Oc, & Tiesdell, 2010) This involves creating a network of clear, logical pathways that seamlessly link to the surrounding urban fabric, making movement easy and enhancing user experience.

Key points:

- Design clear pathways: Create direct, intuitive paths that facilitate easy navigation, avoiding unnecessary turns or dead ends to enhance accessibility.
- Incorporate multiple access points: Provide well-distributed entry and exit points that connect seamlessly with the surrounding street network, increasing space.
- Promote visual permeability: Design open spaces with clear sightlines to improve safety, create a welcoming environment, and encourage exploration.
- Ensure cross-park connections: Include multiple pathways in larger public spaces that link to surrounding streets, encouraging movement and better integrating with its urban context.
- Facilitate easy access to amenities: Position essential services like restrooms and seating along primary pathways, ensuring they are easily accessible and enhancing the functionality of the space.

VIII. Legibility: Enhancing the ease of navigation

Legibility in urban design ensures that public spaces are easily understood and navigated by users. This principle focuses on creating environments where people can quickly orient themselves and find their way without confusion. Achieving legibility involves a combination of clear signage, intuitive pathways, and distinct landmarks that guide users through the space, enhancing both their experience and safety (Carmona, Heath, Oc, & Tiesdell, 2010).

Key points:

- Provide clear signage: Install well-placed signs indicating key connections, destinations, and public facilities. In larger areas, include information on walking times and distances to help users plan their routes.
- Create recognizable landmarks: Design and position landmarks or focal points, like sculptures or unique architectural features, to serve as reference markers and enhance visual interest.
- Ensure intuitive layout: Organize the space with a logical structure that naturally guides users along common routes. Pathways should be direct, leading to significant destinations, and should be wide and well-defined to reduce ambiguity.
- Use visual cues: Incorporate distinct paving patterns, colors, or textures to signal different areas or guide people towards key locations, aiding intuitive navigation.
- Maintain clear sightlines: Design the space with unobstructed views of key areas and exits to help users navigate easily while enhancing safety and openness.

IX. Vitality: Promoting active use of spaces

Vitality in public spaces is essential for fostering a dynamic and engaging environment where people of all ages and backgrounds can participate in a variety of activities. A vibrant space is one that encourages continuous use throughout the day and across different seasons, offering something for everyone. This involves designing spaces that are adaptable, multifunctional, and inviting, ensuring that they remain relevant and well-used over time (Carmona, Heath, Oc, & Tiesdell, 2010).

Key points:

- Design for diverse activities: Create areas for various activities like play zones, fitness areas, and cultural events, attracting a broad demographic.
- Create flexible spaces: Design adaptable areas that can evolve with changing needs, such as a plaza serving as both a quiet space and a market.
- Encourage lingering: Provide amenities like seating, shade, and lighting, as well as features like fountains and public art, to invite extended use.
- Foster social interaction: Include communal seating and picnic spots to enhance social interaction and vibrancy.
- Adapt for seasons: Ensure year-round use with shade structures, windbreaks, and appropriate lighting, and maintain activity through seasonal programming.

X. Imageability: Creating memorable and distinct spaces:

Imageability is essential in public space design, focusing on creating spaces that are both functional and leave a lasting impression. High imageability ensures that a space becomes a recognizable and cherished part of the urban landscape, achieved through distinct features, thoughtful design, and a cohesive visual identity reflecting the area's character and culture (Carmona, Heath, Oc, & Tiesdell, 2010).

Key points:

- Incorporate unique design elements: Use materials and styles that reflect the cultural and historical context, creating a memorable sense of place.
- Integrate art and sculptures as focal points: Public art and sculptures serve as landmarks, enhancing navigation, engagement, and reinforcing community identity.
- Enhance the visual experience with color, texture, and lighting: Thoughtfully use these elements to highlight key features, guide movement, and enhance aesthetic appeal.
- Ensure visual coherence and unity: Ensure that colors, materials, and forms work together cohesively to create a unified aesthetic.
- Create memorable experiences through sensory engagement: Incorporate elements like water features, fragrant plants, and textured surfaces to deepen users' connection to the space.
- Highlight natural and architectural landmarks: Integrate significant natural features or landmarks to anchor the space’s identity.

Evaluating Design Effectiveness in Urban Spaces

To ensure that urban spaces fulfill their intended functions, it is crucial to systematically evaluate their design effectiveness. The process involves assessing how well these spaces meet the public space design objectives, such as accessibility, comfort, safety, and sociability. Evaluating the effectiveness of these spaces requires a combination of both qualitative and quantitative methods, allowing for a comprehensive understanding of how the design impacts user experience and behavior (Carmona, Heath, Oc, & Tiesdell, 2010).

Methods of Evaluation:

- **Post-Occupancy Evaluation (POE)**: While POE is typically applied after a space has been constructed and occupied, gathering feedback from users about their experiences in the space (Becker, 1989), this study acknowledges the importance of POE principles even at the pre-implementation stage. By anticipating the types of feedback that might be collected in a future POE, the current analysis can serve as a predictive tool to ensure that the design aligns with public space objectives and can meet user needs once implemented.
- **Space Syntax Analysis**: Space syntax offers a quantitative approach to evaluating spatial configurations, focusing on the accessibility and connectivity of spaces. By analyzing how people are likely to move through and interact with the space, designers and planners can assess whether the layout promotes effective use and social interaction (Hillier & Hanson, 1984). This method is particularly valuable in the pre-implementation phase to ensure that the spatial design aligns with intended public space objectives.
- **Behavior Mapping**: This method involves observing and recording potential user activities within a modeled environment or similar existing spaces. By mapping out where and how people are expected to engage with the environment, urban planners can identify patterns of use, areas of high or low activity, and potential design shortcomings (Whyte, 1980). This anticipatory approach helps validate whether the design aligns with behavioral expectations outlined in public space design guidelines.
- **Design Alignment with Public Space Objectives**: Another crucial aspect of pre-implementation analysis is evaluating how well the proposed design aligns with established public space design objectives. This involves a detailed review of the design to identify potential strengths and weaknesses in meeting these objectives, ensuring that the final implementation will effectively serve the intended purpose.

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