Lighting with Character: Lighting strategies for public Spaces in Copenhagen - City Center vs. Ørestad

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Abstract:

This thesis investigates how lighting can be used as a design tool to transform underutilized public spaces into socially vibrant, emotionally resonant environments after dark. Focusing on Bella Park in Ørestad, Copenhagen, the study explores how the absence of human-scaled, character-driven lighting contributes to the perception of the park as a transitory, disconnected space. Through a combination of literature review, expert interviews, resident surveys, site analysis, and comparative observation with Copenhagen's historic city center, the project identifies key spatial and atmospheric challenges related to flow, scale, and function.

The research proposes three targeted lighting strategies: gathering geometry, which introduces circular lighting forms to reduce excessive flow and encourage social presence; warm color temperature, to create a more comfortable and slower-paced nighttime environment; and function-specific lighting, to support distinct activities such as play, rest, and nature engagement. Together, these strategies form a scalable, adaptable design approach that reimagines lighting as a catalyst for belonging, identity, and behavioral change.

By grounding design in both theory and real-world analysis, this thesis demonstrates that lighting (when shaped with character) can do more than illuminate. It can evoke atmosphere, guide interaction, and help reclaim the night as a space for community life.

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1 Chapter I: Introduction

Lighting is a fundamental aspect of urban design, influencing not only the functionality and safety of public spaces but also the aesthetic and cultural identity of a city. As Jan Gehl (2010) emphasizes, a well-designed urban environment prioritizes human-scale experiences, ensuring that public spaces remain inviting, inclusive, and visually engaging, especially in the dark hours. Lighting shapes the way we interact with our surroundings, creates a sense of security, and fosters a connection between individuals and the city.

This thesis explores the transformative role of lighting in shaping urban public spaces, specifically, how pedestrian-oriented lighting can enhance areas that currently lack character, turning them into places where people feel comfortable, engaged, and inclined to linger even after dark. The term *"lighting with character"* may seem abstract at first, but its meaning will unfold throughout the development of this thesis. It refers to the intangible atmosphere of a space: an emotional and sensory quality that becomes tied to a specific physical environment. As Bartenbach writes, "light is not merely a means of visibility, but a creator of atmosphere, defining space and giving it emotional weight" (as cited in Schielke & Luck, 2015, p. 17). This understanding positions lighting as a vital element of place-making, particularly during the dark hours.

In this thesis, I will investigate how effective lighting design in urban environments can contribute to a sense of belonging among community members and encourage social interaction. The research will focus on various aspects of lighting, including its aesthetic qualities, functionality, and psychological impact on individuals within public spaces. By analyzing a case study and engaging with local communities, this thesis aims to provide insights and practical recommendations for creating inclusive and inviting urban spaces through scalable lighting strategies (see chapter 8).

More than half of the world's population currently lives in cities, and the United Nations estimates this figure to rise towards 70% by 2050 (UN DESA, 2019). Despite this increasing urbanization, cities are not using their spaces to their fullest potential. Once shops and offices close for the evening, levels of activity in urban centers drop significantly. Night-time presents challenges to cities globally, whether due to safety concerns, a lack of destinations or attractions, or simply the absence of engaging spaces. This issue becomes even more dramatic in cities like Copenhagen, where dark hours do not necessarily coincide with traditional nighttime. Copenhagen gets about 17.5 hours of daylight at the summer solstice and only 7 hours at the winter solstice, people's experience of urban spaces is largely shaped by artificial lighting.

Copenhagen, widely known for its commitment to livability and high urban quality, has long used lighting as a key tool in shaping the city's identity. The Copenhagen Lighting Master Plan (2008) underscores the role of artificial lighting in reinforcing the city's character by balancing functionality and atmosphere. As darkness descends, the lighting in each apartment becomes visible from the street, showing how personal and public spaces alike rely on lighting to create atmosphere.

However, as the city continues to grow, new developments like Ørestad have faced criticism for their failure to uphold these essential lighting principles, leading to a sense of spatial disconnect, lack of identity and lack of pedestrian oriented design.

Accordingly, this thesis proposes the following vision:

Imagine if pedestrian-oriented lighting could transform an outdoor space, currently lacking character, into a lively urban space that attracts people during the dark hours.

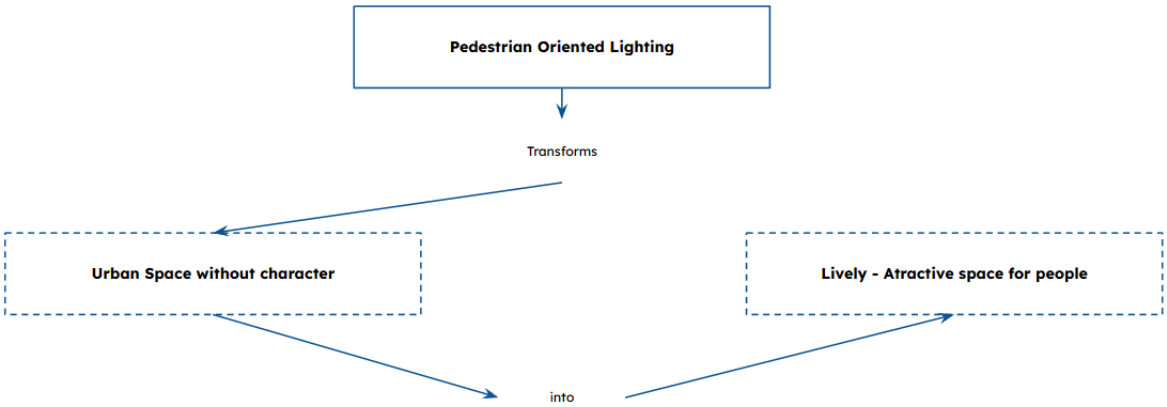

Figure 01: Sketch regarding the vision.

This vision explores how lighting strategies shape the nighttime character of Copenhagen's inner city, using Ørestad as a point of comparison—an area often criticized for its lack of character due to insufficient lighting design. The thesis concludes by testing lighting interventions aimed at enhancing the experience of public spaces after dark.

Figure 02: Pedestrian street at night in Copenhagen

2 Chapter II: Motivation

The inspiration for this thesis comes from both my personal and academic journey. As an architect from Chile, I come from a context where cities are primarily designed for cars rather than people. The human experience often takes a secondary role in urban planning, with wide roads, large-scale infrastructure, and a lack of pedestrian-friendly spaces shaping everyday life.

When I arrived in Copenhagen, I was immediately struck by the city's scale, especially in the historic center, where the urban fabric is clearly designed around the human experience. Streets, buildings, and public spaces come together to form a cohesive environment that feels inviting, accessible, and liveable. In contrast: my experience in Ørestad, where I began my internship and have been working regularly for nearly a year. This revealed a critical gap: the human element appears to have been overlooked.

Due to political and economic challenges (discussed in chapter 5.2) the original masterplan had to be altered. As a result, the relationship between buildings and the spaces between them felt disconnected, designed more for efficiency and scale rather than for people. At night, this absence of a pedestrian-oriented approach became even more apparent, with lighting failing to create a sense of place or belonging.

This gap, the missing human scale in Ørestad's urban lighting and spatial design, forms the foundation of my research. Through this thesis, I seek to explore how lighting can enhance urban spaces, making them more engaging, comfortable, and attuned to human needs, contributing to more thoughtful urban environments.

Figure 03: Santiago - Chie. Vehicle-oriented city

3 Chapter III: Methodology and structure of the thesis

The structure of this thesis follows *The Design Experiment Model*, a transdisciplinary research-by-design methodology developed by E.K. Hansen and M. Hvass (see fig. 04). This model integrates approaches from design, natural sciences, social sciences, and humanities to generate new knowledge through iterative exploration and evaluation. It was introduced in the course *Meaning of Light – Light & Space* and draws on earlier work by Hansen and Mullins (2014).

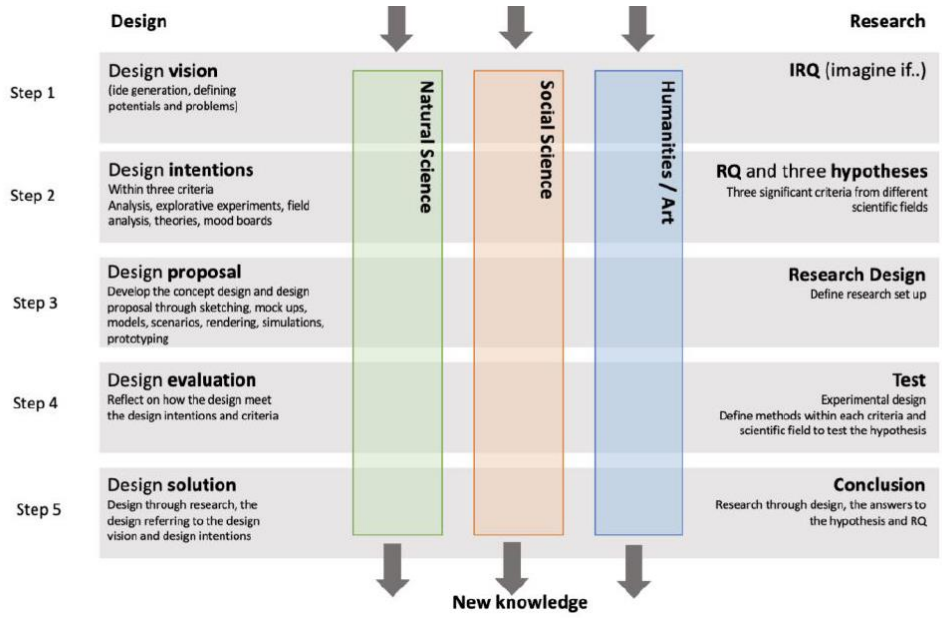

Figure 04: The Design Experiment Model

The thesis is structured in five progressive steps as proposed by the model:

1. **Design Vision**
   This stage involves identifying the central problem and defining the design potentials related to lighting character in urban contexts. It includes initial ideation, and the formulation of research questions and hypotheses based on theoretical reflection and contextual observation.

2. **Design Intentions**
   Here, the research deepens through fieldwork, literature analysis, and conceptual framing. Surveys, site visits, and expert interviews are used to explore the qualities of light in Copenhagen's inner city and Ørestad. These insights help establish criteria across natural, social, and humanistic dimensions.

3. **Design Proposal**
   Based on the findings, this stage includes the development of conceptual lighting strategies through sketching, scenarios, and testing on the specific site (Bellapark). It transitions theory into tangible design proposals.

4. **Design Evaluation**
   The proposals are evaluated against the original intentions and criteria, considering how well they respond to user needs, atmosphere creation, and urban identity. This phase reflects critically on the hypothesis and research questions.

5. **Design Solution**
   Finally, the thesis culminates in a design solution that synthesizes research and creative exploration. The final lighting concept aims to bring "light with character" to Ørestad, informed by the urban qualities observed in the city center.

This structure allows for the integration of empirical knowledge and artistic sensitivity, aiming to bridge the gap between academic research and design practice.

3.1 Methodology of the research

This chapter outlines the **research strategies and tools** employed to investigate the presence of “light with character” in Copenhagen’s inner city, the contrasting lack of such character in Ørestad, and the specific conditions of the selected intervention site-Bellapark.

A multi-method qualitative approach was chosen to address both tangible and intangible aspects of urban lighting, combining literature review, survey-based research, expert interviews, site analysis, and comparative observation. These methods were selected to holistically examine the relationship between lighting design, atmosphere, and users' sense of belonging.

1. Literature Review

The research begins with a literature review focused on defining and contextualizing the term “character” in an urban and atmospheric sense. This includes an exploration of the concepts of urban identity, sense of belonging, and atmosphere. This theoretical grounding serves to define the qualities this thesis seeks to recognize and eventually reintroduce in the case study site.

2. Survey

To build a collective understanding of the more intangible qualities of urban lighting, a survey was conducted in Copenhagen’s city center. This mixed-method tool combined quantitative Likert-scale questions with qualitative, open-ended responses. The aim was to gather personal and shared perceptions of how lighting influences atmosphere, identity, and safety. This data directly informs and supports the development of the conceptual framework for “light with character.”

3. Article-Based Research and Expert Interviews

To understand the urban shortcomings of Ørestad, a review of relevant critical articles and academic texts was conducted. This was complemented by interviews with experts in lighting design, urban planning, and architecture, offering professional insight into the design decisions and challenges specific to Ørestad. These contributions helped clarify why Ørestad struggles to create engaging, characterful nighttime environments.

4. Site Analysis and Comparative Observation

The final method involves a comparative analysis between the inner city and the Ørestad site, inspired by Jan Gehl’s human-centered urban design framework. Drawing from his classifications of necessary, optional, and social activities in public space (Gehl, 2011), pedestrian behaviour and activity types were recorded during both daytime and nighttime. This observational data serves to reveal usage patterns, highlighting the functional and experiential discrepancies between the two locations. Bellapark, the focus site, was analysed in detail, including its existing lighting conditions, spatial layout, and user behaviour.

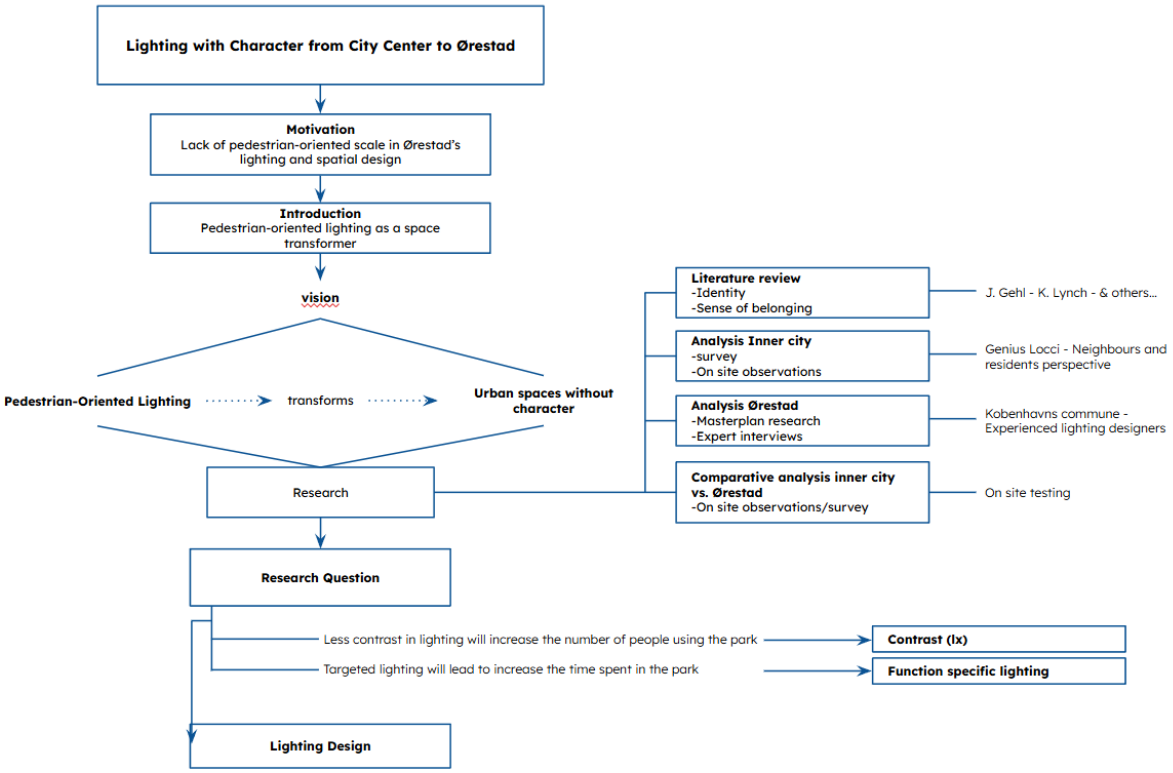

Figure 05: Thesis structure

4 Chapter IV: Literature review

This chapter serves as the foundational framework for the thesis by synthesizing knowledge from a range of academic and professional research sources. Its primary aim is to establish a theoretical and conceptual base from which the research question will be developed. Central to this chapter is the exploration of the concept of *"light with character"*—an idea that suggests lighting can do more than illuminate; it can evoke emotion, foster a sense of belonging, and contribute to the unique identity of a place. The discussion will examine how this concept plays a role in shaping urban environments and enhancing public life.

4.1 Light with character

Before moving forward, it is important to explain what is meant by light with character, as this idea will be used throughout the thesis. In this context, light with character refers to light that does more than just help us see. It creates mood, atmosphere, and a sense of place. It can make a space feel warm and welcoming, cold and distant, calm, mysterious, or full of life. This kind of light affects how we feel in a space and how we understand it, often without us even realizing it.

Sometimes, we walk into a room or environment and immediately get a sense of where we are, geographically or emotionally. The light in that space plays a big role in giving us that feeling. It helps guide us, sets the tone, and even helps us connect with a memory or experience. This is what is meant by light with character: light that tells a story and adds personality to a space.

Throughout this thesis, this idea will be used to look at how light shapes our experience of buildings and environments. It's not just about brightness or visibility, but about how light interacts with surfaces, colours, and materials to create a unique feeling. As Bille and Sørensen (2007) explain, light is not just something in the background, it's a key part of how we feel and understand the spaces around us.

To build on the idea of *light with character*, we need to look more closely at how light shapes not just spaces, but the feelings and moods connected to them. One useful way to explore this is through the concept of *atmosphere*, the emotional tone or quality that a space gives off, often created through the careful use of light.

While the word "atmosphere" is often used in design and academic discussions, it may not always be the term people use in everyday life. In Denmark, for example, people often speak more about *stemning* or *hygge* when describing the feeling of a space. According to Bille (2015), these words carry emotional and cultural meaning that go beyond a simple description of mood. *Hygge* is deeply tied to Danish life, often used to describe a sense of comfort, coziness, and well-being. It refers to a certain way of being together in a space that feels relaxed, intimate, and safe.

Bille explains that *hygge* is not only used to talk about social situations, but also about light itself. A soft, warm light can be described as *hyggeligt* (cozy), especially in the home. This kind of light is not harsh or overly bright, but gentle and calming. It helps create a peaceful and inviting environment, what many might call a "feel-good" space. The concept is so flexible that it can be used to describe everything from a candle-lit dinner to a quiet moment by a window.

Although *hygge* can be hard to translate directly, it generally includes ideas like comfort, cheerfulness, and ease (Hansen, 1976). It's also used to describe an ideal kind of social atmosphere, where people feel at home and at peace.

By looking at *hygge* as an example of how light shapes atmosphere, we can better understand how *light with character* works in practice. It's not just about how a space looks, but how it feels. Light helps create moods that people can recognize and relate to, even if they don't always have the words to describe them. This emotional and cultural connection is what gives light its "character," and makes it such an important part of design.

In conclusion, *light with character* is much more than a simple element of design. It is an emotional experience, deeply connected to human well-being. By understanding the ways in which light shapes atmosphere, particularly through the lens of *hygge*, designers can create spaces that are not only beautiful but also

meaningful and emotionally resonant. This chapter has set the stage for a deeper exploration of how light, as both a physical and emotional medium, can transform spaces into places of comfort, intimacy, and connection.

4.1 Sense of belonging

A sense of belonging is a fundamental human emotional need. It refers to the inherent desire to be accepted as a member of a group, where individuals can maintain close and secure ties, and experience a sense of safety, care, and affection. Belongingness is not merely about knowing or familiarizing oneself with a space or group; it is a deeply emotional and psychological need to give and receive attention, care, and recognition from others. Escalera-Reyes (2020) asserts that "belonging is a strong and inevitable feeling that exists in human nature" (p. 124). Humans are social beings, and as such, they have an intrinsic need to live collectively or belong to groups that provide a sense of rootage, identity, and social reference. Belonging plays a critical role in the formation of communities and societies, acting as one of the most powerful motivators for group formation (Escalera-Reyes, 2020).

The importance of belonging goes beyond the simple act of being physically present in a space. It is the emotional connection to a place and a group that makes individuals feel anchored in their identity. This idea of place attachment, as discussed by Patrick Devine-Wright and Susan Clayton, underscores how the physical environment is intimately tied to a person's sense of self. The bond that individuals form with a specific geographic area transforms that space into an anchor of their identity (Devine-Wright & Clayton, 2010). Place attachment develops over time through affective, cognitive, and behavioral ties, creating a sense of belonging that is both stabilizing and dynamic (Brown & Perkins, 1992). The psychological experience of a place influences an individual's identity and behavior, further enhancing the sense of belonging.

Belongingness is not limited to an individual's connection to a physical location; it also emerges from the shared experiences between individuals and groups. Social interaction in a space fosters communal bonds that strengthen the feeling of belonging. The more time individuals spend in a place, the more they develop shared experiences that contribute to social place attachment. These interactions become part of a collective memory, and over time, these memories help to build a collective identity. As Low (1992) points out, these social connections become symbolic ties that bind people together. The symbols within a space—whether they are physical elements like landmarks or shared experiences—serve as markers of identity that allow individuals to identify with a community. These symbols, rooted in collective memory, play an essential role in creating a strong sense of belonging (Low, 1992).

In the context of urban spaces, lighting can be a powerful tool in creating and sustaining a sense of belonging. When designed thoughtfully, light can enhance the social interactions that foster a sense of community. Moreover, lighting plays an important role in the aesthetic quality and functionality of public spaces, influencing how individuals experience a space and interact with others. As Escalera-Reyes (2020) highlights, lighting can either facilitate or hinder social cohesion. In urban environments, lighting strategies that consider human-scale experiences and social connectivity can significantly contribute to the creation of places where people feel a sense of belonging.

This idea of creating a space where individuals can bond emotionally and socially through lighting is central to the concept of "lighting with character." Lighting, when strategically designed, can reinforce the identity of a place and serve as a symbol for community identity. For instance, in urban areas where social interactions are encouraged by the design of public spaces, light can play a role in reinforcing shared experiences. By illuminating areas in ways that highlight their cultural significance, lighting can enhance people's attachment to those spaces, thus cultivating a stronger sense of place and belonging.

Light can support the process of place attachment in two distinct but complementary ways. First, through the creation of a visually engaging atmosphere, light can enhance the emotional connection individuals feel to a space. For example, in places where light emphasizes architectural features or the natural landscape, it fosters a deeper connection to the environment. These aesthetic experiences become part of the shared memories that individuals build in these spaces. Second, lighting can be functional in promoting social interaction and collective engagement. By providing adequate lighting for communal areas, especially during the evening or nighttime, lighting allows people to feel safe, comfortable, and encouraged to engage with others. As Brown

and Perkins (1992) suggest, the lighting in these spaces can act as a facilitator for social interaction, which is integral to the process of creating collective memories and identity.

Thus, the concept of lighting with character can be seen as an essential element in the design of public spaces that aim to foster a sense of belonging. By carefully considering how light interacts with a space, designers can create environments that not only enhance the functionality and aesthetics of urban areas but also encourage social cohesion and connection. This is particularly important in a time when more than half of the world's population lives in cities, and this figure is expected to rise to 70% by 2050 (UN, 2020). As urban areas expand, cities face challenges in maintaining their vibrancy and inclusivity after dark, when public spaces often become deserted and unsafe.

Urban lighting, when designed with the intention to foster belonging, can transform underutilized outdoor spaces into active, welcoming environments that encourage people to return and interact during the dark hours. Through the thoughtful application of light, designers have the power to create spaces that not only serve functional needs but also support a sense of community, identity, and attachment, thus cultivating urban environments where people feel at home.

5 Chapter V: Analysis

This chapter introduces the two urban contexts that form the basis of the comparative analysis: the historic inner city of Copenhagen and the contemporary urban development of Ørestad. By examining these areas through the lens of lighting and urban design, the chapter aims to identify key spatial and atmospheric differences, laying the foundation for understanding how lighting design contributes to placemaking in distinct urban environments.

To reinforce the analysis and provide a more grounded overview of the historic inner city, a site survey is conducted, focusing on spatial qualities, lighting atmospheres, and user experiences. In contrast, insights into Ørestad are gathered through article-based research, which explores the perceptions and lived experiences of Copenhagen residents in relation to this newer development. Additionally, two expert interviews are included, featuring professionals who were directly involved in the Ørestad masterplan. These interviews provide valuable perspectives on the challenges and considerations faced by lighting designers working in large-scale urban planning contexts.

The chapter concludes with a comparative observational analysis inspired by Jan Gehl's concept of the "life between buildings," which emphasizes the importance of human-scale interactions and public life. This comparative lens helps to establish the conceptual groundwork for the subsequent research question, linking the physical and atmospheric qualities of urban lighting to broader questions of place and identity in contemporary cityscapes.

5.1 Article based Research: Ørestad's masterplan

This chapter presents a collection of article-based research aimed at introducing the district of Ørestad. Through a review of published sources, it outlines the district's development history—how it was initially planned, built, later redesigned, and where it has faced challenges or shortcomings. Additionally, the chapter highlights diverse public perceptions, offering insight into how Ørestad is experienced and understood by different Copenhagen residents.

Ørestad in the Context of Copenhagen

Located south of Copenhagen's historic centre, Ørestad is a modern urban district situated on the island of Amager, strategically positioned between the city's downtown and its international airport. Conceptualized as a bold expansion project, Ørestad was meant to symbolize Copenhagen's urban renewal, driven by a unique financing model in which land sales would fund vital infrastructure, particularly the metro system (Hansen, 2015). Despite these ambitious goals, the district has become a glaring example of market-driven urban planning that lacks the organic qualities of a thriving city. As architect Henrik Valeur (2011) argues, Ørestad appears "more like a real estate product than a city—a place built for investment, not for people." Similarly, Jan Gehl (2010) criticizes large-scale developments that ignore human experience, warning that impersonal urban planning often leads to spaces people avoid rather than inhabit. This critique is echoed by Lars Gemzøe (Gehl Architects), who emphasizes the need for "life between buildings"—a quality largely absent in Ørestad's current design. Today, Ørestad remains physically and socially disconnected from Copenhagen, struggling with issues of identity, functionality, and acceptance among Copenhageners.

Figure 06: Ørestad plan view

The Origins: A Vision for Growth and Connectivity

At the end of the 1980s, Denmark faced economic stagnation and high unemployment. In response, the Danish Parliament passed the 'Act of Ørestad' in 1992, marking the first major state-driven urban development project in decades. The objective was to create a new metropolitan district that would attract both national and international investment, leveraging major infrastructure projects such as the Øresund Bridge to Malmö and a new metro system.

The planning of Ørestad was guided by the master plan of Danish architecture firm KHR Arkitekter, which envisioned a high-density urban area that would integrate nature and sustainability. The district was divided into four smaller sections, theoretically fostering a balanced mix of residential, commercial, and recreational spaces. However, this vision was compromised by the top-down nature of the project, which largely excluded public participation, despite Denmark's strong tradition of civic engagement in urban planning.

As Fainstein (2009) notes, "Recently we have witnessed the mounting of very large development projects in European and American cities. There is a striking physical similarity among the schemes and a convergence embodied in private-sector involvement and market orientation" (p. 768). Ørestad follows this trend, **prioritizing economic gains over urban quality.**

Figure 07: Ørestad throughout time from 2004 to 2024

Planning and Development: A Public-Private Imbalance

Unlike organic urban growth, Ørestad's development was dictated by the Ørestad Development Corporation, a public-private entity tasked with financing and overseeing the project. The metro system was a crucial part of this plan, designed to provide connectivity while simultaneously boosting property values along its route. As Majoor (2008) states, the metro was intended to "especially target high-paying multinational private firms" (p. 138), underscoring the project's market-driven character.

The financing model, however, introduced significant risks. **The reliance on land sales to cover metro costs created a dependency between urban development and real estate speculation**, embodying what Sennett (2006) criticizes as 'the closed system'-a planning approach where economic equilibrium dictates urban form, often at the expense of quality public space. Sennett (2006) states, "The closed system ruled by equilibrium derives from a pre-Keynesian idea of how markets work. It supposes something like a bottom line in which income and expenses balance […] familiar to urban planners in the ways infrastructure resources for transport get allocated" (p. 2).

When the expected demand for office and residential space failed to materialize, the financial instability of the project forced the state to turn further toward private-sector solutions, leading to the construction of Fields, the largest shopping mall in Scandinavia, as a revenue-generating safeguard.

The Shopping Mall: A Symbol of Market-Driven Urbanism

Opened in 2004, Fields was envisioned as a commercial anchor for Ørestad. However, rather than fostering street life, the mall became an inward-facing structure, further isolating the district from the rest of the city. As Kvorning observes, “The large shopping mall was allowed to turn in an inward-facing direction, without the slightest attempt to create life in the surrounding streets” (as cited in Christiaanse, 2009, p. 187).

The mall’s construction violated Danish planning principles that generally discourage large out-of-town retail developments to protect local businesses (Majoor, 2008). Furthermore, it intensified public opposition to the project, as environmentalists criticized its impact on traffic and the natural landscape.

The failure of Ørestad to cultivate a vibrant urban environment is further underscored by pedestrian data. Gehl’s (2007) research on Kay Fiskers Square, the district’s supposed central plaza, found that despite 7,000 daily metro users passing through, **only an average of 5.5 people occupied the square at any given time.** In contrast, Oslo’s Aker Brygge Square, with a comparable pedestrian count, hosts an average of 212 people at any moment. This statistic highlights Ørestad’s inability to generate organic street activity and social interaction.

The Lack of Urban Identity: Ørestad as an Isolated District

Ørestad’s greatest failure is its inability to integrate into the urban and cultural fabric of Copenhagen. Rather than evolving into a cohesive, livable district, it remains a fragmented collection of isolated developments, lacking the mixed-use dynamism that defines successful cities. As Fainstein (2009) argues, large-scale developments often consist of “luxury residences and hotels, large-footprint office towers and shopping malls […] lacking the layering of old and new, small and big, that gives central cities their ambiance and opportunities” (p. 783). This critique is particularly relevant to Ørestad, where an absence of small-scale, organic development has left the area devoid of authenticity.

Moreover, the very mechanisms that were supposed to finance and sustain Ørestad have backfired. Due to low demand, many apartments and office spaces remain unoccupied, and the area has failed to attract the vibrant business and residential communities initially envisioned. As Simon Kjær Hansen (2015) points out, the financing model, based on land sales to fund infrastructure, was “overly optimistic,” leaving parts of the district underdeveloped and underpopulated. Henrik Valeur (2011) further critiques the district’s planning, arguing that Ørestad was “planned and implemented in a technocratic and market-oriented way, with little regard for public involvement or urban life.” The lack of civic engagement in the planning process, as noted by various critics, has only deepened the disconnect between Ørestad and the rest of Copenhagen.

Despite its ambitious origins, Ørestad stands as a cautionary tale of market-oriented urban planning. **While it succeeded in financing Copenhagen’s metro system, it failed to create a livable, integrated urban district.** The top-down planning approach, the dominance of private-sector interests, and the prioritization of economic returns over community engagement resulted in a sterile and disconnected environment.

Today, Ørestad remains an outlier in Copenhagen: an isolated, unpopular district that lacks the urban identity and organic vitality that define the rest of the city.

5.2 Expert interviews: Lighting Design in Ørestad

In this chapter, two unstructured interviews with experienced lighting designers provide valuable insights into the Ørestad masterplan project. The unstructured interview method was chosen for its flexibility, allowing the experts to share their knowledge and experiences in a more open and conversational format. As Kvale (1996) explains, "Unstructured interviews provide a way of understanding the lived experiences of participants,

allowing for the emergence of new themes and perspectives." This approach encourages a deeper exploration of the nuances of lighting design and its impact on urban spaces, particularly in the context of Ørestad.

Both lighting designers were selected for inclusion in this thesis due to their direct involvement in the Ørestad masterplan, bringing first-hand experience and expert knowledge to the discussion. Their perspectives are particularly relevant for understanding the challenges and opportunities that arose during the design and implementation of lighting strategies in this large-scale development.

The interviews also serve as a foundation for selecting a specific site within Ørestad for further analysis in this thesis. Through the insights gathered, one location within Ørestad will be chosen as a focal point for detailed examination, allowing for a deeper understanding of how lighting design has shaped the public space and its function within the broader urban landscape.

5.2.1 Interview 01

To better understand the spatial and perceptual implications of lighting in Ørestad, an interview with an experienced architectural lighting designer: Sabine Møller, was conducted. Møller has worked with firms such as Henning Larsen, Rambøll Arkitektur, and iGuzzini, contributing to projects that emphasize how light influences both architectural expression and human experience. Her insights offered valuable perspectives on the often-overlooked emotional and narrative dimensions of urban lighting.

In discussing her work on the Urban Light project, Møller described her approach of creating the illusion of an imaginary light source, a method aimed at enhancing textures, materials, and spatial character through indirect or shielded lighting. As she put it, the intent is to “bring out the materials and the facades of the spaces through light without having the light source as the main character”. This reflects a preference for ambient strategies that prioritize atmosphere over visibility.

A particularly compelling part of our discussion was Møller’s analogy between wind tunnels and light tunnels. Ørestad’s wind tunnel effect, caused by large-scale buildings and open urban grids, is a well-documented urban issue.

Møller suggested that a similar experience occurs with the uniform lighting systems in the district. “These light sources are placed at the same distance, with the same typology and output,” she explained, “and they form a kind of visual corridor, almost like the wind tunnels people talk about” This repetitive lighting pattern, along the elevated metro, adjacent pedestrian paths, and canal-side bike lanes, creates a spatial rhythm that communicates speed and transience, rather than encouraging pause or interaction.

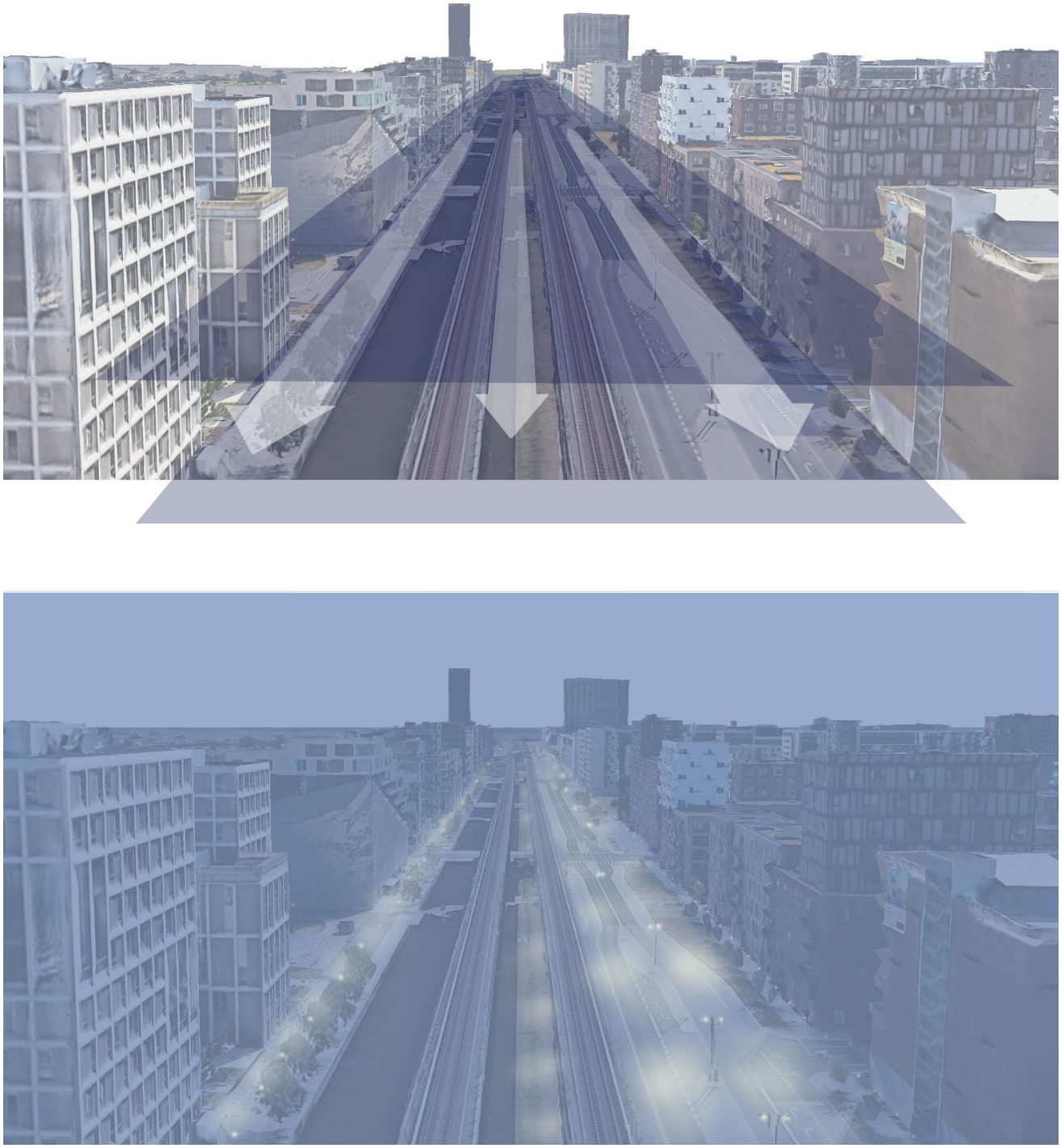

Figure 08: Sketch about analogy from "Wind tunnels" to "Light tunnels" in Ørestad

This observation echoed my own experience in Ørestad. Despite the technical brightness of the area, particularly along the stream, the space often feels perceptually dark and exposed. I shared with Møller that "I feel unsafe," not due to an absence of light, but due to its lack of variation and scale. There is a contrast between zones, and the lighting design does little to articulate human-centered spatial hierarchies. As I noted during our discussion, "It's not completely dark, but the contrast makes it feel that way. You feel like you are on a stage, being flashed with a light, and there's nowhere to hide".

There were also reflections on the perception of emptiness within the urban landscape. In some areas, built facades on one side of the canal face open, undeveloped spaces on the other. These areas are not physically empty, but they become invisible at night, disappearing due to a lack of lighting articulation. Møller

emphasized that this perceived void, while spatially real during the day, becomes emotionally amplified through unbalanced and directional lighting schemes.

Her insights challenge the conventional logic of uniform illumination as inherently functional. Instead, she advocates for layered and site-specific lighting strategies that respond to activity levels, movement, and emotional needs. Within the context of Ørestad, this perspective invites a reevaluation of how light can be used not only to see, but to feel grounded, move intuitively, and experience the identity of place in more nuanced ways.

5.2.2 Interview 02

Pernille Bech-Larsen is a senior lighting designer at SLA, specializes in creating urban spaces that balance functionality, aesthetics, and human experience. With a background in architectural lighting, she has contributed to projects that emphasize how light can shape movement, atmosphere, and identity in the built environment. During the interview about Ørestad, Bech-Larsen highlighted the critical role lighting plays in defining the character of the area and how current design choices contribute to its challenges.

According to Bech-Larsen (personal communication, March 20, 2024), Ørestad is an unusual addition to Copenhagen, an area dominated by landmark architecture where every building competes for attention. This focus on individual architectural statements has resulted in a fragmented urban environment with poor microclimates between buildings, discouraging people from lingering. While lighting has the potential to enhance public spaces, much of Ørestad's lighting design follows a functional, efficiency-driven approach rather than one that invites engagement. She noted that uniform light levels and excessive spill light, which remain on long after office hours, further contribute to the area's sterile and unwelcoming atmosphere.

To address these issues, SLA is rethinking public spaces in Ørestad through a more human-centered approach to lighting. Bech-Larsen explained that new designs aim to create spaces that slow movement rather than simply facilitating flow, encouraging people to explore rather than pass through. This includes introducing dark zones to promote biodiversity, using lower bollards with wider spacing to define spaces more subtly, and employing catenary lighting in plazas to guide people intuitively on how to use the space.

Bech-Larsen differentiates between "fast light": uniform, efficiency-driven illumination and "plaza light": more varied and character-driven lighting designed to enhance the experience of public space. By integrating lighting strategies that respond to both human and environmental needs, Ørestad has the potential to transition from a disconnected architectural showcase to a more inviting and livable urban district.

Figure 09: Sketch resuming problematics in Ørestad

5.1 Survey: Copenhagen's Inner City

To move beyond subjective impressions and begin building a shared understanding of what constitutes *light with character* in the context of Copenhagen's city center, an initial site-specific study was conducted. This research aimed to document how urban lighting is perceived and experienced by those who interact with it daily: residents, visitors, and users of public space.

To achieve this, a survey was designed incorporating both quantitative and qualitative methods. Quantitative elements, such as Likert scale questions, were used to assess general attitudes, satisfaction levels, and perceptions of light-related attributes (such as brightness, warmth, or atmosphere) in a structured and measurable format. Complementing this, open-ended qualitative questions invited respondents to describe their subjective experiences, memories, or emotional reactions related to lighting in the city center.

This mixed methods approach not only captures statistical trends but also uncovers the deeper meanings and associations people form with illuminated spaces. As Creswell and Plano Clark (2018) emphasize, combining qualitative and quantitative data provides a richer, more holistic understanding of human-centered urban phenomena.

This survey helps to ground the concept of *lighting with character* in real-world, lived experience, offering a foundation from which to contrast the lighting conditions in Copenhagen's historic core with other places.

The survey was conducted online and distributed via email to Danish residents living in Copenhagen, resulting in forty-one responses. It was designed to gather both qualitative and quantitative data on how lighting and urban atmosphere are perceived in the inner city.

The survey results reveal that public perception of Copenhagen's urban lighting is generally positive, though nuanced. Nearly half of respondents (49%) believe the current lighting fits the city's identity and aesthetics, while 37% feel it only partially does, suggesting that although the design is broadly appreciated.

Figure 10 and 11: Suspended Road lighting in Inner City

Regarding safety, the overwhelming majority (91%) of participants reported feeling either completely or mostly safe walking in the city centre at night due to the lighting, indicating that it successfully fulfils a key functional role in the urban environment. When asked whether the lighting appropriately highlights architectural, historical, or cultural elements, most respondents expressed moderate agreement—56% somewhat agreed and 20% slightly agreed—implying that while the lighting contributes to showcasing the city's heritage, it may not be doing so to its full potential. Overall, the findings suggest that Copenhagen's lighting is effective in fostering safety and is generally aligned with the city's identity, but further enhancements could be made to strengthen its cultural and aesthetic impact.

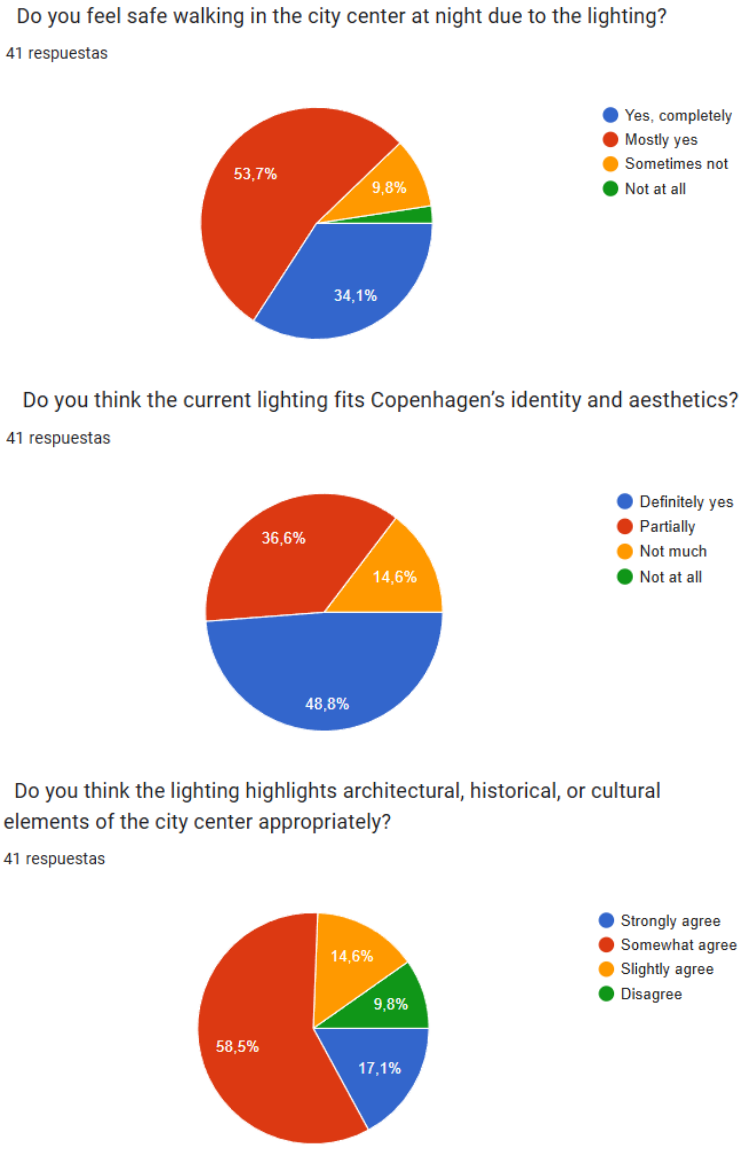

Figure 12, 13 and 14: Results on survey

As part of the study on urban lighting in Copenhagen, survey participants were asked to describe their perceptions of three interrelated aspects: the design of lighting elements (such as lamp posts and fixtures), the atmosphere created by the city's lighting, and their overall impression of nighttime lighting in the city center.

The responses reveal a consistent appreciation for the subtlety and character of Copenhagen's nighttime lighting. Participants frequently described the **design of lighting fixtures,** such as lamp posts and hanging lights, as **minimalistic**, **functional**, and **aesthetically integrated** with the city's historic and architectural context.

Many noted that the fixtures are **unobtrusive** or even **invisible**, which reinforces their harmony with the urban landscape rather than standing out. While a few saw them as **uninspiring or standard**, others praised the **Nordic style**, describing them as **beautifully designed**, **never demanding attention**, and **fitting well with the city's identity**.

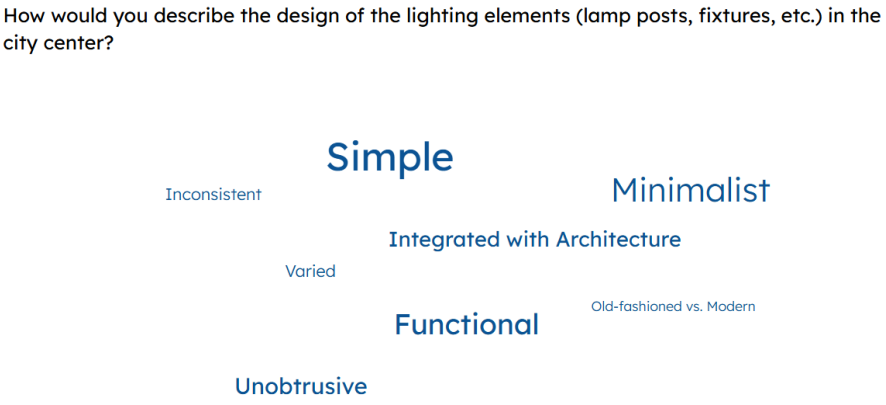

Figure 15: Results on survey

The **atmosphere created by the lighting** was characterized as **cozy**, **calm**, **hygge-inspired**, and **inviting**, with the lighting contributing to a sense of **safety**, **warmth**, and **charm**. Although some noted variation between districts, ranging from **romantic and magical** to **boring or chaotic,** the dominant narrative suggests a lighting approach that fosters a strong emotional and cultural connection.

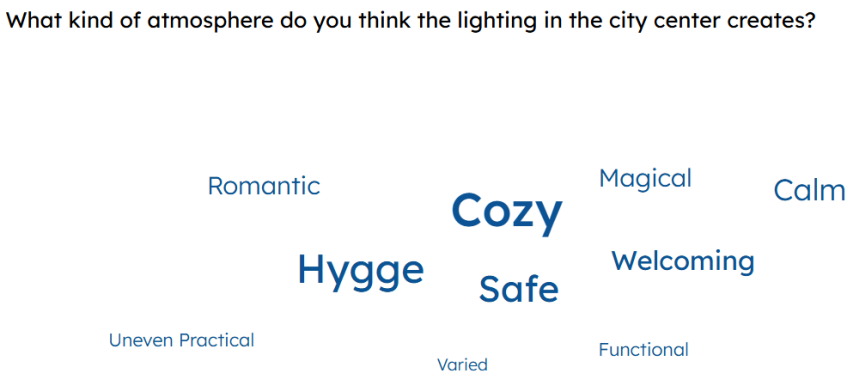

Figure 16: Results on survey

Similarly, the overall perception of nighttime lighting in central Copenhagen emphasized qualities like **dimmed**, **soft**, **warm**, and **human-scaled**, with many expressing appreciation for the **low light pollution**. A few responses pointed out functional gaps, particularly regarding **uneven brightness levels**, **dark spots**, or the **impact of commercial signage**, but these were the exception.

Altogether, the feedback highlights that Copenhagen's lighting strategy successfully blends **functional needs with atmospheric design**, reinforcing the city's **aesthetic identity** and its **pedestrian-friendly, intimate ambiance**.

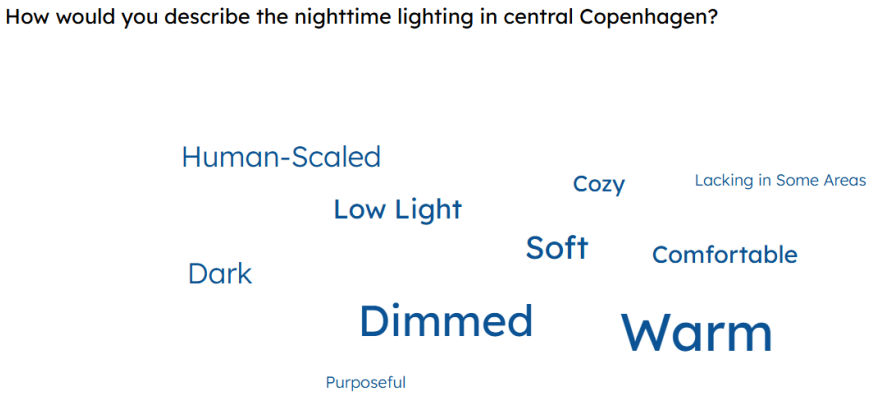

Figure 17: Results on survey

5.1.1 Conclusions from Interviews 01 & 02: Light as a Definer of Movement

Both interviews confirm that lighting in Ørestad plays a crucial role in shaping how people move through space. Sabine Møller describes how uniform lighting patterns create "light tunnels" that, like wind tunnels, encourage fast, linear movement rather than pause or interaction. This type of design pushes people through space instead of inviting them to stay.

Pernille Bech-Larsen reinforces this by contrasting "fast light"- which promotes flow- with "plaza light," which slows people down and encourages social use. Her approach focuses on using light strategically to guide movement, define spatial purpose, and create zones for lingering.

Together, **the insights underline that light doesn't just illuminate, it directs**. In Ørestad, rethinking lighting as a tool to influence movement and behaviour is key to transforming sterile, transit-focused spaces into places of identity and human engagement.

5.2 Site Analysis: Bella Park in Ørestad

For developing concrete lighting solutions, a specific site was selected. The criteria for this choice were shaped through conversations with SLA lighting designer Pernille Bech-Larsen, whose work has contributed to improving the liveability of multiple public spaces in Ørestad. SLA's approach emphasizes the combined role of landscape and lighting design in activating urban life. However, Bella Park remains one of the areas yet to be redesigned. This makes it a relevant testing ground, as it embodies many of the spatial and perceptual challenges identified throughout the research.

Figure 18: Public space in between buildings

Bella Park is positioned between a 33-meter-tall residential building and a 36-meter-tall office building, with the park itself measuring approximately 39 meters in width. This creates an almost 1:1 vertical-to-horizontal ratio, which causes the park to feel smaller and more enclosed than its actual size would suggest. The space lacks openness and proportion at the human scale, reducing the sense of comfort and usability typically associated with inviting public spaces. As Jan Gehl points out, “when the scale is too large, people feel small, exposed, and not invited to linger” (Gehl, 2011, p. 46). This effect is not just visual but also psychological, shaping how people relate to the space and whether they choose to stay or move through it.

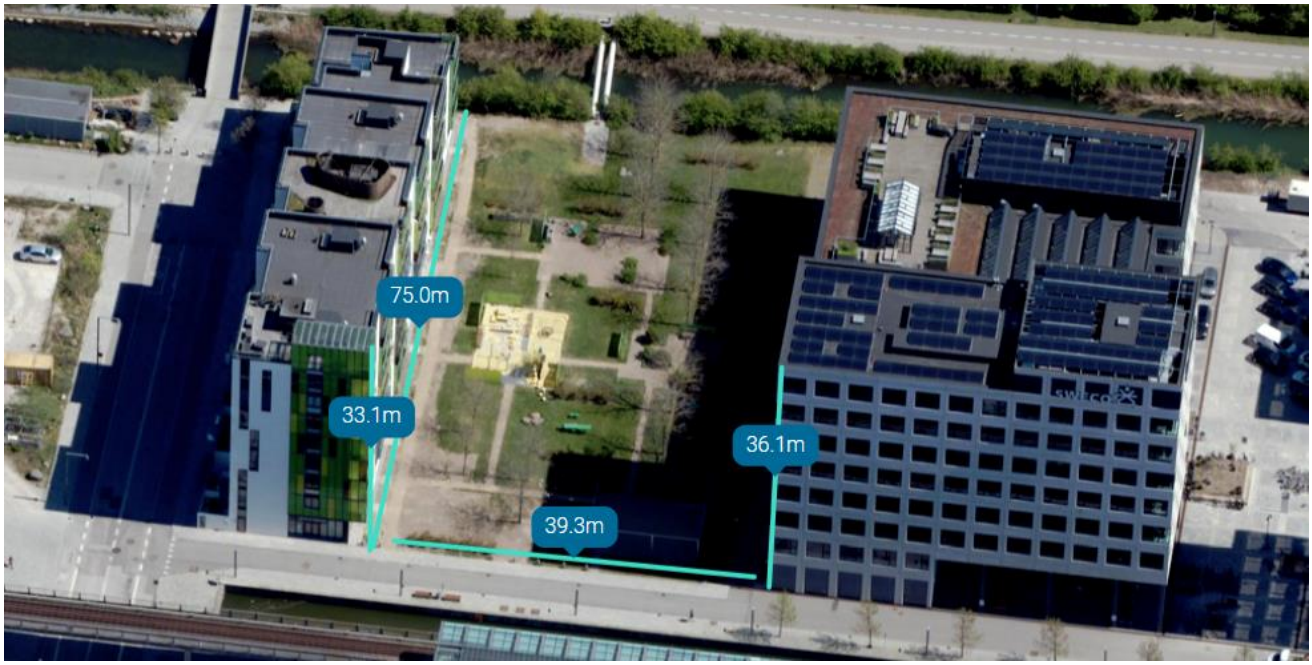

Figure 19: Dimension of park and surrounding buildings.

At night, this imbalance is heightened by lighting conditions. Uncontrolled light spillage from the adjacent tall buildings results in an uneven distribution of brightness, with brightly illuminated facades overpowering the much darker ground surface of the park. This leads to a vertical dominance in the lighting hierarchy, where the eye is drawn upward rather than toward the space intended for social use.

The lighting conditions at Bella Park were analyzed using two complementary parameters to evaluate both quantitative and qualitative aspects of the current nighttime lighting environment.

The first method involved on-site illuminance measurements taken on the vertical plane, specifically at a height of 0.1 meters above ground level to simulate the pedestrian eye level while seated and to account for low-angle light reflections. Measurements were recorded using a professionally calibrated Hagner Model T2200-x lux meter. Calibration was confirmed within the last six months to ensure measurement accuracy. The readings were taken on a grid with a spacing of approximately 1.22 square meters (corresponding to a 1.1m x 1.1m interval), allowing for a granular mapping of light distribution across the park's open surface. This grid methodology enabled a clear identification of local light disparities and the detection of lighting hotspots and underlit areas.

Figure 20: Luxmeter used for measurements

The second method involved a luminance analysis using false-color imagery processed through Fusion Optix LightTool software. Photographs were captured using a high dynamic range (HDR) camera mounted on a tripod at a fixed position. The software processed the HDR images to reveal spatial luminance variations across the vertical (facades) and horizontal (park ground) planes. The output was interpreted using the standard color-coded luminance scale, enabling visual quantification of luminance ratios and contrast patterns across the scene. This method provided deeper insight into how lighting is perceived and how it contributes to the overall visual hierarchy of the space after dark.

The results from both the lux measurements and the luminance analysis indicate a significant imbalance in lighting distribution. Illuminance levels on the horizontal plane (the park ground) were notably inconsistent, with lower light levels concentrated away from the edges and toward the central zone. This pattern is largely driven by uncontrolled light spill from the office building's extensive glazed façades, which emit a high volume of light into the public space. These façade surfaces registered luminance levels up to ten times higher than the adjacent ground plane.

The calculated average luminance ratio between vertical and horizontal surfaces is approximately 1:10 (see Fig. 21,22), indicating a dominance of vertical light that undermines spatial coherence and comfort. This imbalance contributes to a visual and psychological disconnect in the space: the vertical surfaces dominate the viewer's perception, drawing attention away from the intended social and recreational functions of the park. Rather than encouraging staying or social engagement, the park reads more as a transitory zone.

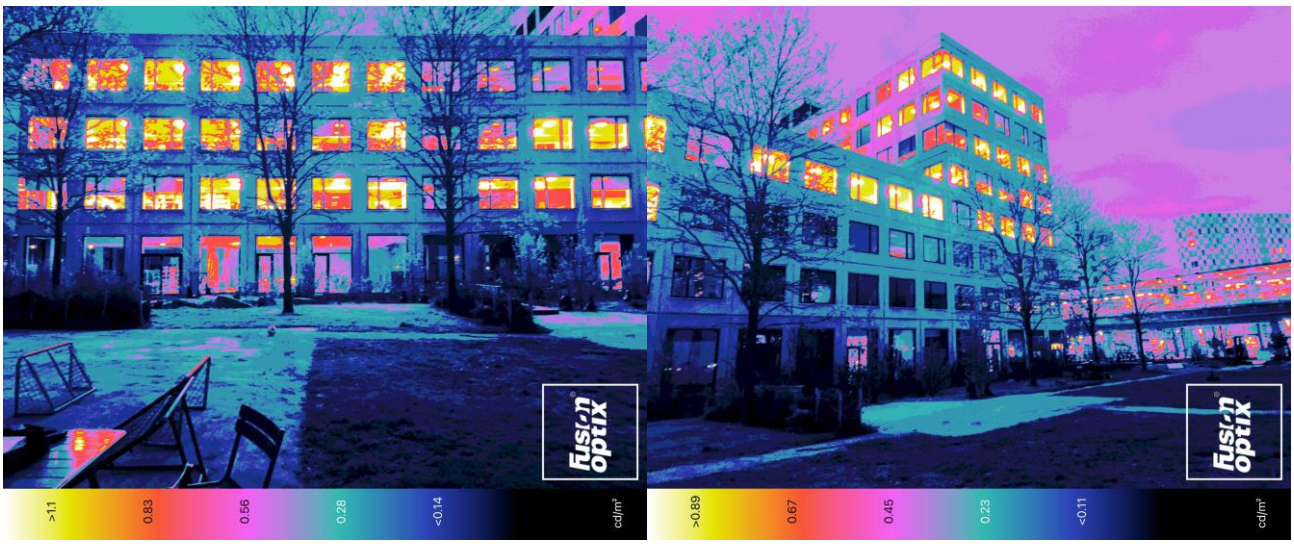

Figure 21 and 22: False colour images from Fusion Optix

These contrast in the light distribution highlights the need for targeted lighting interventions that restore horizontal wayfinding, foster a sense of intimacy, and support human-scale interaction. The analysis forms the empirical foundation for the subsequent hypotheses and proposed design strategies, which aim to re-balance light in ways that enhance usability, comfort, and the emotional character of Bella Park during nighttime hours.

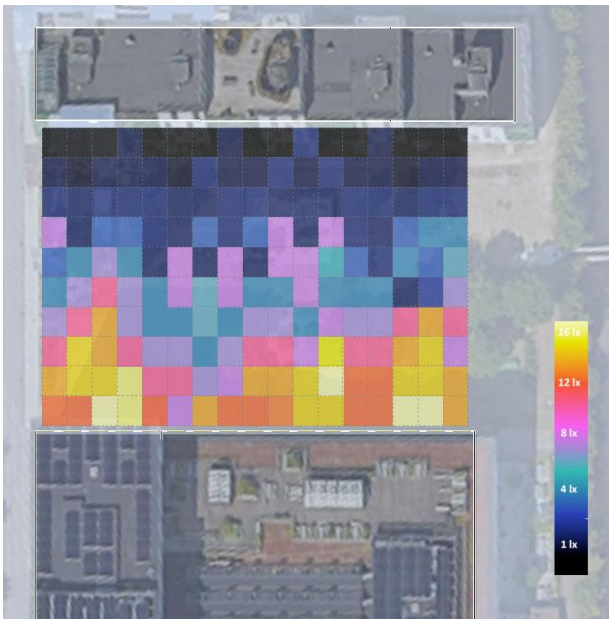

Figure 23: Illuminance measurements and grid distribution.

However, it is not only the stark contrast in lighting levels that creates a problematic condition, equally critical is the **non-uniform light gradient** produced by the previously mentioned uncontrolled façade spill light. As visible in the luminance diagram, this results in an ambiguous lighting scenario with no clear spatial hierarchy or intentionality.

Crucially, the areas receiving the most illumination, primarily those adjacent to the building, correspond to vegetated buffer zones, not areas designed for social use. In contrast, the zones intended for human activity, remain underlit and functionally inaccessible during dark hours.

At the time of measurement, there were no dedicated lighting fixtures installed within Bella Park itself. The only sources of illumination are indirect spill light from adjacent residential and office buildings and uniform street lighting from surrounding pedestrian and bicycle infrastructure. On the perpendicular axis, this

infrastructure features a linear lighting layout, with poles installed at regular rhythmic intervals that reinforce a sense of transit and movement rather than pause or interaction.


Figure 24 and 25: Bella Park during day and night

The street lighting system consists of luminaires mounted on 4-meter poles, emitting light at a correlated color temperature (CCT) of 3500K. This cool, neutral-white light contributes to the fast-paced, corridor-like atmosphere of the surrounding streetscape. Measurements were taken using a spectroradiometer UPRtek MK350N Premium, a standard instrument for precise color temperature and spectral distribution assessment.

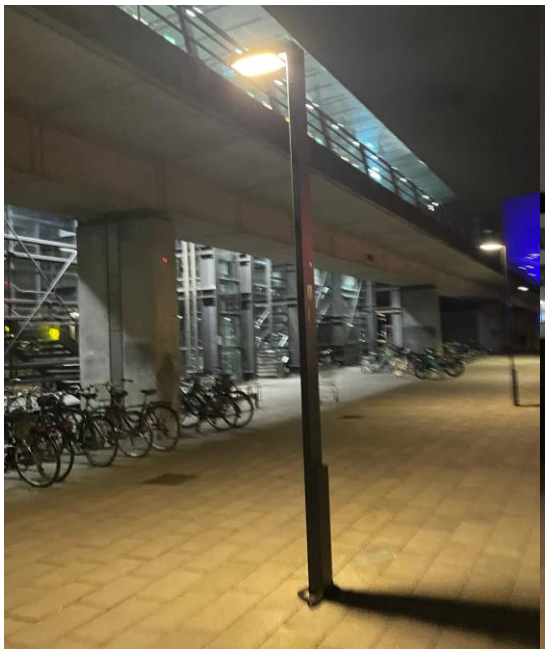


Figure 26 and 27: Street light adjacent to the park.

An important distinction to establish in Bella Park (one that will serve as a foundation for later lighting strategies) is the functional division of space within the site. As it currently exists, the park is already physically segmented by a grid of orthogonal pathways, arranged in both longitudinal and transversal directions. Rather than forming clear, navigable connections between activity zones, these paths often act more as dividers than connectors, unintentionally separating rather than integrating the park's various uses.

Figure 28: Bella Park and it's (un)connecting paths.

Several functional areas can be clearly identified: a mini football pitch, a barbecue zone with fixed grilling equipment, a children's play area, and a more loosely defined lounge zone with seating. In addition to these social spaces, portions of the park are occupied by semi-wild vegetation, serving ecological or aesthetic functions. Due to the rectilinear structure of the paths, these programmatic zones are naturally framed into square and rectangular sections, which are legible and intuitive to navigate during daylight hours.

However, at night, this spatial logic becomes nearly invisible. With the absence of general or pathway lighting, users are left to guess the direction and purpose of the routes, resulting in confusion, disorientation, and a reduced sense of safety and comfort. This condition underscores the need for lighting not only as a tool for visibility but also for spatial legibility and functional identity, helping users to understand where they are, where they're going, and what each zone is intended for, even after dark.

5.3 Observation Analysis with Gehl's "Life Between Buildings"

This chapter builds on the findings from earlier research by analyzing how people use public space in two contrasting areas of Copenhagen: Ørestad and the historic city center. The goal is to better understand how design influences human activity and interaction in urban environments.

The framework for this analysis is based on Jan Gehl's Life Between Buildings (2011), which highlights the importance of observing real-life behavior in public spaces. Gehl divides outdoor activities into three categories:

- Necessary activities – things people must do, such as commuting or running errands.
- Optional activities – things people choose to do when conditions are pleasant, like walking, sitting, or exercising.
- Social activities – interactions with others, either spontaneous or planned, such as conversations or group play.

Gehl emphasizes that the presence of optional and social activities depends on the quality of the physical environment. As he writes, "If the quality of outdoor areas is poor, only strictly necessary activities occur. As quality improves, optional and social activities multiply" (Gehl, 2011, p. 11).

Jan Gehl's *Life Between Buildings* (2011) offers a framework for understanding how the design of public space directly shapes human behaviour. One of his core arguments is the importance of the **human scale**, where cities must be "experienced at five kilometres per hour" (p. 21) that is, from the perspective of a walking

person. At this speed, sensory elements such as texture, lighting, sound, and enclosure become essential in creating comfort and orientation.

Gehl also notes that "life unfolds on the ground floor" (p. 37), emphasizing the significance of active and inviting edges, zones where people feel safe, observed, and socially anchored. He explains that people are naturally drawn to edges because they offer both protection and visual interest (p. 41). Another important concept is the idea of **invitations to stay**. According to Gehl, "people tend to stay where there are good reasons to do so" (p. 151), and these reasons are often subtle: benches, shelter from wind, or small moments of beauty that make a place feel welcoming. He also highlights how "lighting can influence the atmosphere in a decisive way" (p. 163), shaping emotional tone and patterns of use, especially after dark. Finally, Gehl underscores that public spaces can foster a **sense of belonging** when people feel emotionally connected to a space, they are more likely to return, linger, and care for it (p. 117).

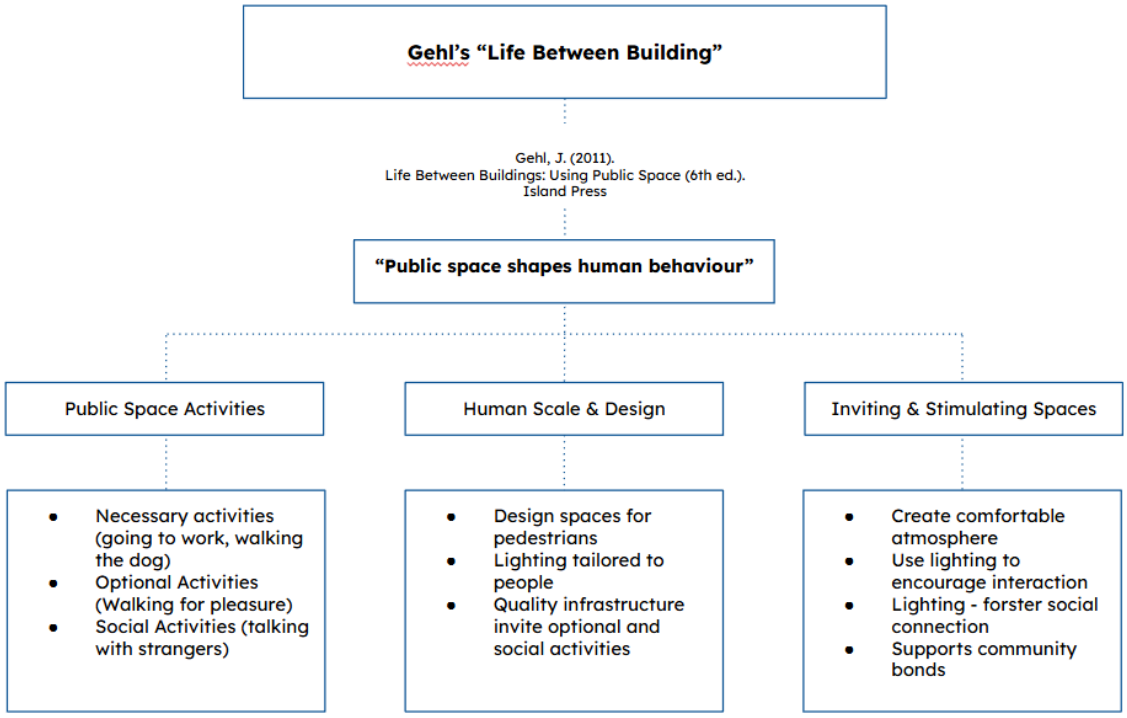

Figure 29: Book diagram sum up

These ideas form the basis of our small-scale observational test in Ørestad's Bella Park. While the park offers some physical infrastructure, it lacks the sensory richness, edge activation, and emotional resonance that Gehl describes. By comparing Bella Park to a site in the historic city center, where Gehl's principles are more visibly present, the test aims to explore how public space design can better support social life, comfort, and identity.

The study involves observing and recording the number of people in each location and classifying their activities using Gehl's categories. Bella Park (Bellaparken) in Ørestad has been selected for closer analysis due to its relevance to the variables identified earlier (see Chapter 5.4).

By applying Gehl's ideas to both sites, this study aims to show how thoughtful urban design - day and night - can support more active and engaging public spaces.

5.3.1 Comparative Observation: Inner City vs. Ørestad

To explore how urban space quality influences pedestrian activity, this experiment involves a **comparative analysis** of two distinct locations in Copenhagen:

1. A site in the **historic inner city**, known for its pedestrian-friendly design and human-scale urban fabric. (see fig. 30)
2. A site in **Ørestad**, a newer development often criticized for its lack of urban character and sparse pedestrian activity. (see fig. 31)

Figure 30: Observation standing point in the Inner city.

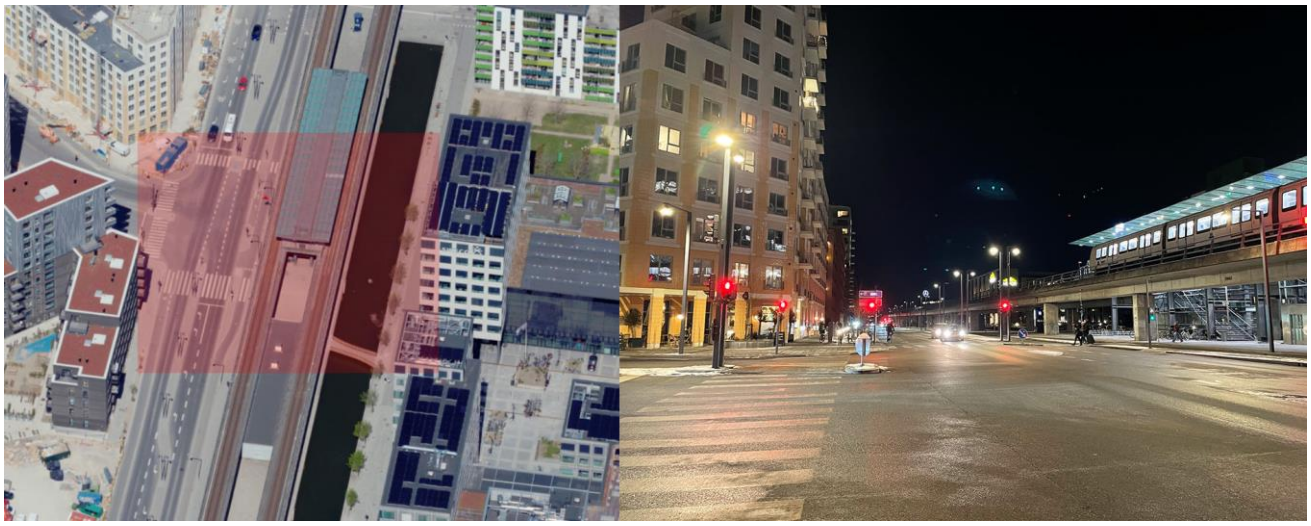

Figure 31: Observation standing point in Ørestad.

By observing and counting the number of pedestrians at each location and categorizing their activities as **necessary**, **optional**, or **social**, the study aims to identify differences in public space usage and evaluate how urban design may impact public life.

This small-scale observational study serves to ground theoretical insights from Gehl's work in real-world urban environments, contributing to a broader understanding of how thoughtful design – including lighting – might encourage richer, more active use of public spaces, especially after dark.

Location	Date	Time	Necessary	Optional	Social	Total	Observations
Bella Park	16/04/25	15:00–16:00	102	0	4	106	Mainly people moving from workplace to metro
Bella Park	16/04/25	20:00–21:00	22	0	0	22	Mostly people walking dogs or passing through quickly
City Center	15/04/25	15:00–16:00	202	118	55	375	Nearly all optional/social behavior disappears.
City Center	15/04/25	20:00–21:00	21	182	302	505	Rich in social interactions and diverse optional activities

Table 01: Observations of activities in two points during day and night.

The data supports Jan Gehl's theory that *"life between buildings"* is deeply influenced by the **quality of public space**.

- **Ørestad** shows a dominance of **necessary activities** during the day, with almost no optional or social engagement. At night, pedestrian activity drops significantly to stay, interact, or linger.
- In contrast, the **City Center** supports a **high volume of optional and social activities** during both day and night. This suggests that its human-scale design, inviting atmosphere, and diverse functions provide the right conditions for people to **choose** to spend time in public space, even after dark.

This comparison confirms Gehl's point that *"when outdoor areas are of poor quality, only strictly necessary activities occur. When outdoor areas are of high quality, necessary activities take place with approximately the same frequency - but they tend to last longer. In addition, a wide range of optional activities will occur."* (Gehl, 2011, p. 11)

6 Chapter VI: From Analysis to research Question

Moving forward from analysis to design intervention, it is essential to bring together the key findings from the different components of this research: the literature review, expert interviews, site analysis, surveys, and comparative observations. Each method has contributed to a layered understanding of the challenges and potentials in Ørestad, particularly in Bella Park.

The **literature review** introduced foundational concepts about human experience in urban space. The works of Christian Norberg-Schulz (*Genius Loci*, 1980) and Kevin Lynch (*The Image of the City*, 1960) emphasized the importance of identity, legibility, and atmosphere in shaping a meaningful relationship between people and place. Jan Gehl's *Life Between Buildings* (2011) added a behavioral dimension, showing how spatial quality affects the frequency and type of outdoor activity. His insight that "necessary activities take place with approximately the same frequency - but they tend to last longer" in high-quality spaces (Gehl, 2011, p. 11) provides a critical clue: improving environmental comfort can extend how long people choose to stay in a space.

Expert interviews with urban researcher Sabine Møller and lighting designer Pernille Bech Larsen underscored that that many feel detached from local public spaces, describing them as cold, empty, or transitioning with the analogy of "light tunnels and wind tunnels" that describe both the physical harshness and psychological sense of pass-through spaces. A recurring desire among residents was for spaces that invite **exploration** rather than **speed**, and for lighting that supports a warmer, more pedestrian-scaled experience after dark.

The **open survey** forcity residents revealed lighting plays a central role in shaping emotional response, supporting social interaction, and contributing to a sense of belonging. They reinforced that light should not be treated merely as infrastructure but as an active design tool for public life.

The **article-based research** and background into Ørestad's **masterplan** highlighted how economic and political constraints led to a lack of cohesive spatial identity. The planning prioritised large-scale infrastructure over fine-grained, livable detail, resulting in public spaces that often feel disconnected and underused.

Through **site analysis and observation**, Bella Park emerged as a key testing ground. Despite its centrality and potential, the space currently suffers from uncoordinated lighting, poor spatial definition, and low nighttime engagement. Observations showed that people gravitate to building edges where facade lighting spills out, but avoid the central areas of the park, which remain poorly activated. These conditions reveal a gap between the physical presence of light and its functional or emotional effectiveness.

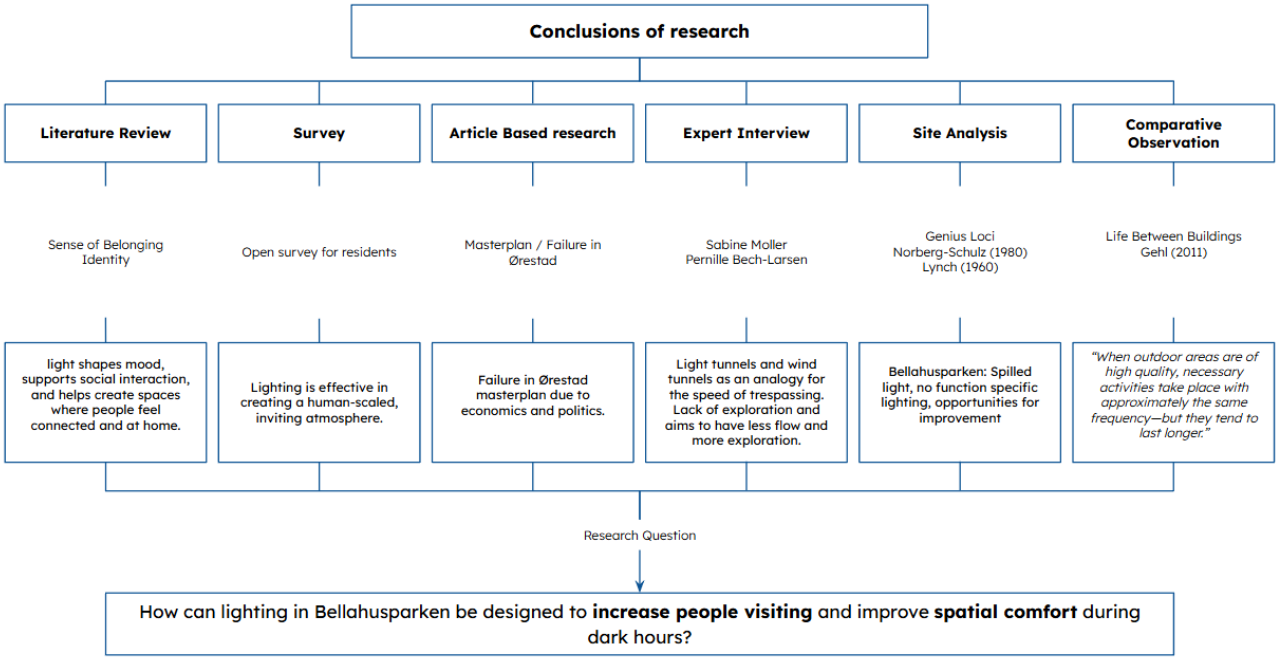

Figure 32: From analysis to research question

Together, these findings form the foundation for the central question of this thesis:

How can lighting in Bella Park be designed to increase number of visitors and improve spatial comfort during dark hours?

This research question aims to move from identifying spatial problems to testing how lighting design, as a pedestrian-oriented intervention, can support public life and foster a greater sense of belonging in Ørestad.

7 Chapter VII: Hypotheses

In line with the initial vision: “Imagine if pedestrian-oriented lighting could transform an outdoor space, currently lacking character, into a lively urban space that attracts people during the dark hours”, this thesis explores how lighting can improve public life in Bella Park. Building on previous research findings, this chapter presents two hypotheses, each addressing a specific aspect of lighting design and its potential impact on nighttime use of the space.

The first hypothesis examines the role of overall light uniformity in influencing how people distribute themselves spatially. The second investigates whether activity-specific lighting can increase engagement and extend the time people spend in designated functional zones. Both hypotheses will be tested through measurable observations of user behavior and lighting conditions. The results will inform the final lighting design by establishing key constraints and opportunities grounded in real-world data.

7.1 Hypothesis 1: Light Uniformity and Spatial Use

While the contrast between vertical and horizontal lighting is clearly perceived on-site at Bella Hus Park, its intensity varies over time. Through discussions with the facility management team of the adjacent office building, it was learned that the facade lighting is not fixed—it is triggered by motion sensors inside the building.

A night guard is required to walk all floors at least once every hour. As they move, the ceiling-mounted LED panels are activated and stay on for 30 minutes unless re-triggered. Because the facade is made almost entirely of glass, the internal lights are fully visible from the outside, creating a strong vertical glow that shifts depending on the time and guard activity.

This unpredictable lighting spill results in fluctuating contrast levels across the park. During the test, horizontal illuminance readings were taken at several distances from the building to document these gradients. Observations focused on how users responded to these light conditions—particularly whether they avoided or engaged with the darker central areas of the park.

Understanding the behavior of this dynamic lighting system was key to testing Hypothesis 1:

> ***Reducing the light contrast between the horizontal surface (park) and vertical surface (neighboring façade) will promote a more inviting environment and with that increase the number of people using Bella Park during nighttime hours***.

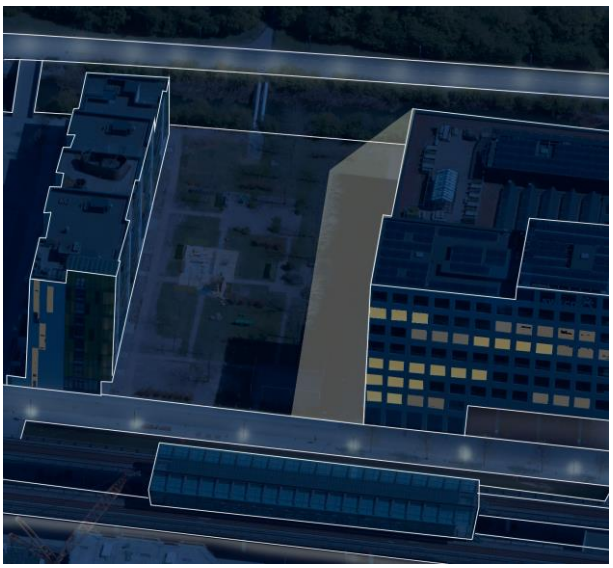

Figure 33: Sketch showing spilled light in Bella Park.

Following the design experiment methodology outlined in Chapter 3, this hypothesis is tested using measurable parameters to generate actionable results for the final lighting proposal. The experiment consists of a comparison of horizontal illuminance (lux) levels under two conditions:

Normal condition – with the building's facade partially lit due to standard motion-triggered lighting.

Test condition – with the facade lights turned off.

To enable the test condition, the facility management team of the adjacent office building coordinated with the property owner to manually disable the automated lighting system. A 30-minute window was granted during which the facade remained dark. This rare opportunity allowed for on-site lux measurements across the park's surface and visual comparison between the two lighting states.

By analyzing how the change in vertical luminance affects horizontal uniformity and perceived usability, the test provides data to assess the validity of Hypothesis 1 and inform the next steps in the design process.

Figure 34: False Color images showing façade of neighboring building

While the measurable component of the test: horizontal illuminance levels was straightforward to conduct, the second part of the hypothesis aimed to explore how lighting contrast influences user behavior, using Jan Gehl's framework of necessary, optional, and social activities. However, due to the limited 30-minute time window during which the facade lighting was turned off, it was not feasible to carry out a full behavioral observation session before and after the change in lighting conditions.

As a result, the test evolved into a spatial perception exercise focused on participants' ability to visually acknowledge and orient themselves toward elements in the park under the two lighting conditions. During the 30-minute window, four test participants engaged in this exercise, in parallel with the horizontal lux measurements.

Despite the small sample size, the findings were meaningful. The lux readings confirmed the drastic change in light distribution across the horizontal plane once the vertical lighting was turned off. This supports the initial atmospheric impression: that the glow from the building facade creates a perceptual imbalance, dominating the visual field and suppressing the legibility of the central park area.

As shown in the figure below, the removal of vertical luminance significantly reduced glare and improved visual clarity of nearby ground-level elements, aligning with the hypothesis that greater light uniformity enhances spatial comfort and orientation.

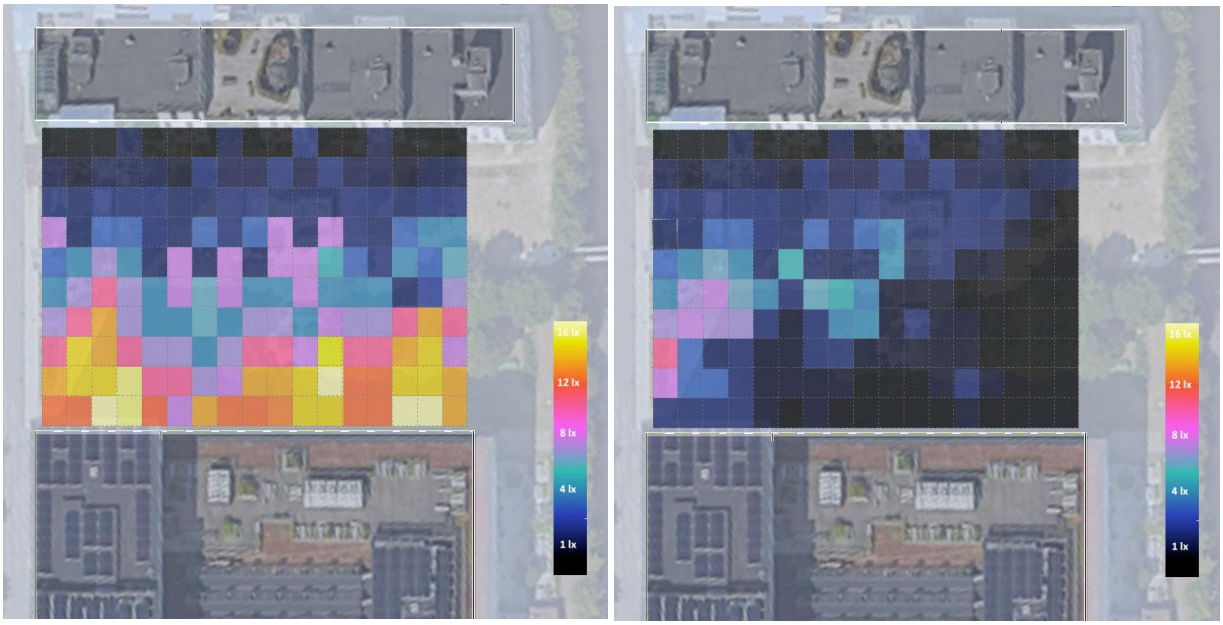

Figure 35: Comparison between lighting conditions with and without light spill from building façade.

Following the lux measurements conducted during the 30-minute facade darkening window, a spontaneous perceptual test was performed to assess changes in visual clarity and spatial awareness under differing lighting conditions. The testing group consisted of the author and two additional participants. While initially unplanned, this qualitative assessment emerged from a noticeable shift in visual perception during the test period.

Figure 37: Dark façade building in the 30-minute dark window

As our eyes adapted to the darker environment (absent of facade glare) we began to experience an increased sensitivity to ambient light levels and a more refined awareness of the surrounding environment. In technical terms, this aligns with scotopic adaptation, where the human eye adjusts to low-light conditions, enhancing peripheral vision and contrast detection.

To evaluate this adaptation in spatial terms, participants positioned themselves at a fixed point adjacent to the building and were asked to identify the furthest clearly distinguishable physical element within the park. After the 30-minute dark period ended and the building lighting resumed, the same exercise was repeated from the identical position.

Despite prior familiarity with the site, participants reported reduced clarity and increased visual strain in the second phase. Elements that had been easily recognized during the low-glare condition appeared blurry or overpowered by vertical light spill, confirming a degradation in depth perception and spatial legibility.

These observations were recorded on-site through handwritten notes in a field notebook, capturing subjective impressions immediately during and after the exercise. While informal and based on a small sample, the results support the hypothesis that minimizing vertical-to-horizontal light contrast enhances both visual comfort and perceptual orientation within the space.

Preliminary results

This informal yet insightful perceptual exercise added an unexpected qualitative layer to the hypothesis testing. While the initial aim was to observe behavioral change through Gehl's activity categories, the short time window led to a different but equally revealing form of engagement—focused on visual clarity, depth perception, and contrast awareness. The results support the idea that **reduced contrast between vertical and horizontal lighting improves spatial legibility and comfort**, aligning with both measured data and atmospheric impressions.

As Mette Hvass (2017) notes in her research, *"the results show that in some cases darkness can provide more visibility than light. When contrasts in lighting levels between two lit zones are removed, a visual contact is created between people in a space and people in the surroundings, which leads to an increased feeling of safety"* (p. 172). This perspective supports the finding that the darkened facade allowed participants to perceive the space more clearly and comfortably.

It is important to note, however, that the **spontaneous nature of this test and the small sample size** raise important questions about methodology and validity. These aspects will be critically examined in the **Discussion** chapter, where the limitations and potential of such improvised on-site assessments will be further explored.

7.2 Hypothesis 2: Activity-Specific Lighting and Engagement

As discussed in previous chapters, Bella Hus Park is informally organized into a series of functional zones, each intended to support different types of social and recreational activities. During daytime hours, these zones are visually and spatially delineated by a grid of orthogonal pathways, which create a clear division between uses such as the playground, lounge/seating area, mini football pitch, grill zone, and nature sections. While the layout is not formally marked, the geometry of the path network provides a legible structure that helps users intuitively understand the space and its intended functions.

However, as night falls, this spatial clarity deteriorates. The absence of dedicated lighting in the park causes these zones to lose definition, making it difficult for users to perceive where one area ends and another begins. As a result, functional intention and spatial orientation break down, limiting the park's usability and safety during dark hours. This challenge forms the basis for Hypothesis 2:

> **Introducing targeted lighting (e.g., 2700K at 20 lux) to support specific functions such as play, seating, and barbecue areas will lead to increase in time spent in those areas during nighttime hours.**

Foto 38: Bella Park in the dark

To explore the potential of function-specific lighting, a small-scale test was conducted to simulate the effect of introducing warm, targeted illumination in selected zones of the park. The test was carried out under real-world conditions, though it should be noted that some uncontrolled variables were present, particularly light spill from adjacent buildings and the continuous street lighting surrounding the park. These sources could not be fully isolated but were accounted for in the analysis.

The first step involved establishing a baseline understanding of the existing color temperature in the area. Using a spectrometer, the correlated color temperature (CCT) of the light spilling from the nearby residential building balconies was measured. On average, this spill light registered at 2700K, indicating a warm light tone consistent with domestic exterior lighting. This information provided a useful reference point for the proposed lighting design, confirming that introducing 2700K lighting in activity zones would be visually compatible with the broader ambient conditions of the park. (See figure 39).

Figure 39: Matching CCT from house to park

The next step in the experiment involved illuminating the selected functional zones—playground, lounge, grill, and football areas—while maintaining control over specific lighting parameters. The aim was to evaluate the perceptual impact of warm, low-intensity lighting, without introducing bias from the appearance or form of the luminaires themselves. To achieve this, the light source was intentionally concealed from view. The goal was to isolate and assess only the ambient lighting conditions each setup created, rather than participants reacting to the design or style of the fixture.

For this purpose, linear battery-powered lamps were used. These fixtures featured dimming capability and tunable white control, allowing for precise adjustments of intensity and color temperature. All zones were illuminated at approximately 2700K, consistent with the measured ambient light from nearby residential balconies, and adjusted to low horizontal illuminance levels (~20 lux) suitable for each activity type. The concealed placement of fixtures ensured that the focus remained on spatial experience and comfort, rather than on the lighting equipment itself.

Figure 40: Battery lamps used on testing hypothesis 2

Zone	Dimming Level (%)	CCT (K)	Notes
Lounge Area	100%	2200K	Warmest light to promote comfort and lingering
Playground	50%	2700K	Moderate lighting for visibility and safety
Grilling Area	70%	2700K	Warm light to enhance social interaction
Nature Section	0%	–	Left unlit to preserve darkness and ecology

Table 02: Lighting parameters per different zones.

The final step in the experiment was to conduct an evaluative analysis through a comparative visual method. To assess the effect of the newly introduced lighting conditions across different functional zones, a collage was created, placing all the illuminated areas side by side. This allowed for a direct comparison of spatial atmosphere, perceived comfort, and functional clarity under varied lighting configurations.

Each zone was evaluated based on how well the lighting supported its intended use, focusing not only on visibility but also on the emotional tone and contextual coherence of the light. The lounge area, with its warm 2200K light at full intensity, produced the most inviting and intimate atmosphere, reinforcing its purpose as a space for relaxation. The playground, while moderately lit at 2700K and 50% dimming, was visually legible and safe but less emotionally expressive. The grill area, at 70% and 2700K, balanced functional brightness with a warm, social ambiance suitable for shared activity. Finally, the nature section, intentionally left unlit, preserved a sense of visual calm and darkness that contrasted with the other zones and added depth to the overall composition.

The findings suggest that targeted, warm lighting tailored to specific functions can significantly enhance spatial legibility and emotional engagement in public spaces after dark. The collage method proved effective in visualizing how subtle shifts in light quality can shape atmosphere and user perception. This supports Hypothesis 2 and provides valuable design insight for implementing function-based lighting strategies in the final proposal.

Figure 41: Collage showing Bella Park with and without zone lighting

8 Chapter VIII **Final Design: Scalable Lighting Strategies**

While this design proposal is applied to Bella Park in Ørestad, its purpose extends beyond the boundaries of the site. The interventions developed here are not intended as a one-off solution, but as a set of adaptable lighting guidelines aimed at enhancing the experience of similar public spaces, particularly those that suffer from underuse, scale disconnects, or poor nighttime engagement.

The goal is not only to provide a fixed site-specific blueprint, but to offer a framework that can be scaled and adapted to other contemporary urban parks or transitional open spaces with comparable conditions.

This chapter presents a cohesive lighting design proposal for Bella Park, structured around distinct yet interrelated strategies. Each lighting intervention is crafted to address specific urban challenges identified in earlier chapters. Such as excessive flow, lack of spatial identity, and contrast in light distribution. While these strategies are modular and can be applied individually to accommodate different contexts, they are also intended to function as a unified system. When implemented together, they establish a dialogue between form, function, and atmosphere, shaping a nighttime environment that is spatially coherent and emotionally resonant.

The design is not a one-size-fits-all solution but rather a toolkit of lighting gestures. These gestures vary in tone, position, and intensity depending on the desired behavioral and perceptual outcome. Yet they all share a central aim: to transform Bella Park from a transient, underutilized corridor into a socially active and identity-rich public space after dark.

8.1 Strategy 1: Gathering Geometry

The first strategy targets the problem of excessive linear flow through the park, a condition amplified by the surrounding urban fabric of Ørestad. As discussed in previous chapters, the rhythm and uniform spacing of existing light poles, often aligned longitudinally along circulation paths, reinforce a sense of movement rather than pause. This uniformity encourages a quick traversal of the space, inhibiting exploration and discouraging people from stopping or engaging with the site.

To counter this, the intervention introduces a circular lighting formation, a geometric contrast to the rigid linearity that dominates Ørestad. The circle is a timeless spatial symbol of gathering and enclosure, found across cultures and species as a formation that signals safety, intimacy, and inclusion (Alexander, 1977). By embedding this shape within the lighting design, the proposal encourages slower movement and social clustering.

As Christopher Alexander notes in A Pattern Language:

> *“A group of people feels most comfortable and natural when they can see each other’s faces. This means they will almost always arrange themselves in a circle or a semi-circle.”* (Alexander, Ishikawa, & Silverstein, 1977, p. 610)

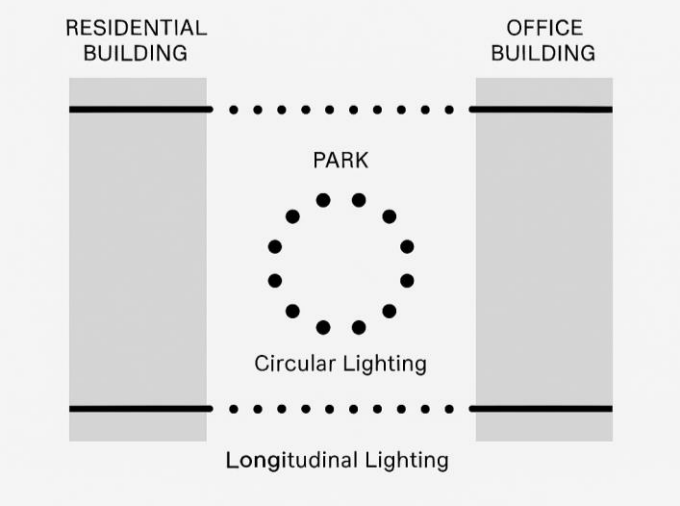

Figure 42: Sketch showing gathering geometry

Strategically placed low-level, warm-colored luminaires (e.g., 2700K) will define these circular zones, creating soft "islands" of light that visually and emotionally invite users to stop, linger, and interact. These zones will be in areas identified as underused or transitional, reprogramming them into focal points of nighttime activity. The lighting intensity in these circular areas will be moderate (30–50 lux), balancing visibility with comfort, and avoiding the glare or over-illumination that currently characterizes the vertical facades.

In this way, the design not only interrupts the park's current flow but redefines it, setting the pace for a slower, more pedestrian-oriented experience. The circle becomes both a spatial and symbolic anchor, a pause in the rhythm of the city that encourages connection, presence, and place-making.

Figure 43: Render showing gathering geometry

Figure 44: Render showing gathering geometry

8.2 Strategy 2: Slowing Down and Enhancing Comfort

As observed in the site analysis and case studies, the surrounding infrastructure of Bella Park is dominated by cool white street lighting, typically around 4000K, which is known to enhance visibility and support fast-paced movement. This uniformity and chromatic coldness, while functionally efficient for roads and transit, reinforces the perception of the park as a transitory space rather than one meant for lingering or social interaction. (Zielinska-Dabkowska, 2015)

To counterbalance this effect, the second lighting strategy introduces warm white light (2200K-2700K) in targeted areas within Bella Park, such as seating zones, play areas, and pathways that are intended for lower-speed, high-engagement use. The goal is to create a contrasting visual and psychological atmosphere that slows people down and encourages them to pause, interact, and feel at ease.

As lighting expert Karolina Zielinska-Dabkowska notes:

> *"Cool white light supports alertness and activity, whereas warm white light promotes relaxation and social behavior, helping people to feel comfortable and to linger."* (Zielinska-Dabkowska, 2015, p. 38)

This principle is central to the intervention: by strategically lowering the CCT in zones meant for social and recreational use, the design creates a more emotionally resonant and human-scale environment. The contrast between cool peripheral lighting and warm interior lighting enhances spatial legibility and provides visual cues about the intended use of different park zones. In effect, light becomes a behavioral guide, gently shifting the atmosphere from one of movement to one of rest.

Figure 45: Render showing warm CCT

Figure 45: Render showing warm CCT

Figure 45: Render showing warm CCT

8.3 Strategy 3: Function-Specific Lighting

The third lighting strategy focuses on function-specific illumination, designing lighting conditions that correspond directly to the diverse uses and social behaviors within Bella Park. Unlike the previous strategies, which address spatial flow and atmosphere more broadly, this intervention relies on the micro-zones within the park to support usability, comfort, and identity during dark hours.

Through site analysis and observation, three distinct programmatic functions were identified within the park:

A mini football pitch (small-scale, informal use),
Communal barbecue and seating areas,
Natural vegetation zones (planted areas in development),

And a grid of orthogonal pedestrian paths that traverse the park but don't actively connect to the functional spaces.

Despite the richness of potential use, these zones are disconnected in practice, especially after dark, due to a complete absence of targeted illumination. This strategy aims to introduce functional lighting, transforming these isolated spaces into cohesive nighttime destinations.

Mini Football Pitch

A modest level of 30–50 lux of uniform horizontal illumination is proposed using low-glare, wide-beam luminaires mounted on poles or architectural fixtures. A neutral white color temperature (3500–4000K) ensures adequate visibility for informal play without overwhelming the scale or atmosphere of the park. This level is approximately 10 times brighter than the current baseline (close to 0 lux), yet still within pedestrian-oriented thresholds for small recreational areas.

Barbecue and Lounge Areas

These spaces prioritize social interaction, rest, and comfort. Warm white lighting (2700K) with low illuminance levels (10–20 lux) will create an inviting ambiance, supporting conversation and a sense of intimacy. Lighting may be integrated into pergolas, bollards, or tree-mounted fixtures to preserve visual comfort and avoid glare.

Natural Planted Zones

These areas will be illuminated minimally to maintain ecological sensitivity. Low-output ground luminaires or bollards with diffuse, shielded optics will softly articulate vegetation edges and pathways. Lighting here acts more as a spatial boundary and texture enhancer than as a visual focus.

Pathways

Instead of dominant linear lighting, the paths will be subtly marked using asymmetric fixtures or indirect ground lighting at 5–10 lux. This breaks the rigid, transit-focused rhythm of Ørestad's typical street lighting and encourages lateral movement into functional zones.

This function-specific approach not only improves safety and usability but also builds emotional and spatial legibility - allowing users to instinctively understand what each area is for and feel encouraged to engage with it.

Rather than applying a blanket lighting solution, this strategy recognizes that people behave differently in spaces meant for play, rest, or passage. By tuning light levels, CCT, and beam spread to match these behaviors, the design invites people to inhabit Bella Park in more meaningful, diverse ways after dark.

9 Chapter IX: Discussion

While this thesis set out to test two well-defined hypotheses through measurable and observable parameters, it is important to critically assess the limitations and methodological shortcomings of the testing processes—particularly in relation to replicability, objectivity, and technical rigor.

Hypothesis 1: On Light Contrast and Spatial Use

The test for Hypothesis 1, which aimed to assess how reducing light contrast between vertical and horizontal planes would affect the use of Bella Park, was partially compromised by logistical constraints. The experiment depended on a rare and brief opportunity (granted by the facility management of a neighbouring building) to switch off the automatic lighting for a 30-minute window. While this allowed for accurate lux measurements and some basic spatial perception exercises, it did not provide sufficient time to conduct the planned behavioural observation exercise using Jan Gehl's activity categories (necessary, optional, and social).

Instead, the test pivoted toward an improvised perceptual exercise with a small number of participants. Although this generated interesting qualitative insights, it lacked the systematic structure and scale necessary for robust, replicable findings. The spontaneity of the test limited its methodological depth. In future applications, a more comprehensive and time-extended study, including repeated observations and larger participant samples, would be essential to validate the initial hypothesis and draw more reliable conclusions.

Moreover, the absence of control over ambient lighting conditions, such as spill from nearby infrastructure, adds further complexity to interpreting the results. While real-world conditions often resist perfect isolation, future studies could benefit from controlled pilot installations, ideally in collaboration with local authorities or developers, to better simulate post-intervention scenarios.

Hypothesis 2: On Function-Specific Lighting and Spatial Comfort

The testing of Hypothesis 2 involved a simulated approach based on targeted lighting configurations across predefined functional zones within the park. Although technically more controlled in terms of CCT and lux values, the assessment of comfort, atmosphere, and invitation was conducted solely by the author, based on professional experience and design training. While a trained lighting designer can offer informed spatial judgments, this introduces a degree of subjectivity that limits the generalizability of the findings.

Perceptions of comfort and invitation are inherently context-dependent and influenced by personal, cultural, and environmental factors. In this case, the evaluations were not supported by user feedback, observational data, or structured surveys. As such, the outcomes (though visually convincing and atmospherically compelling) remain qualitative impressions, rather than empirically validated user responses.

A more reliable method for assessing comfort and usability would involve post-occupancy evaluation tools such as structured interviews, ethnographic observation, or perceptual mapping with diverse participants. Additionally, applying established frameworks from environmental psychology or human factors engineering could help translate atmospheric qualities into quantifiable indicators of emotional response, usability, or spatial identity.

Reflecting on Methodological Balance

Overall, the testing phase of the thesis reflects a creative but constrained attempt to validate theory through practice. The results, while aligned with the broader hypotheses, should be seen as exploratory rather than conclusive. They offer valuable design direction and qualitative insight but must be expanded upon through further research to establish statistical relevance and interdisciplinary rigor.

This discussion does not diminish the value of the tests conducted, but rather highlights the importance of transparency and critical self-reflection in design-based research. As urban lighting becomes increasingly central to public space planning, bridging the gap between subjective design intuition and objective evaluation methods will be essential to building environments that are both emotionally resonant and technically sound.

Observational Survey: Limitations and Scale

The comparative observational survey conducted to analyse user activity types categorized as necessary, optional, and social per Jan Gehl's methodology, offered valuable initial insights into how public life unfolds differently in the city centre versus Ørestad. However, the survey's limited scope and duration present several important methodological shortcomings that affect the reliability and accuracy of the results. Observations were carried out from a small number of standing points and during a restricted time window, which does not sufficiently capture the complex variability of public space use.

User behaviour in urban spaces is influenced by numerous external factors, including time of day, day of the week, season, weather conditions, and the presence of events or nearby activities. As such, capturing a representative pattern of usage requires systematic and repeated observations over an extended period. In this case, the survey was conducted over a short timeframe, which may have coincided with atypical conditions, potentially intervening in the distribution of activity types observed.

To strengthen the validity of such a comparison, future studies should include multiple observation sessions across various days of the week and times of day, ideally from a wider set of vantage points that cover different spatial and functional zones within each site. A larger sample of observations would allow for statistical normalization and help distinguish between anomalies and consistent behavioural patterns.

While the current survey did reveal clear differences between the two sites, particularly in terms of the dominance of necessary activities in Ørestad and the greater presence of optional and social behaviour in the inner city, these findings should be considered preliminary. They serve as a strong basis for design development but require expansion at scale to support more definitive claims about public life patterns and the impact of lighting on behaviour.

Perception of Lighting Character: Gaps in Resident-Based Data

Another important limitation in this research lies in the survey and analysis of lighting character, which was conducted only in the inner city. The survey focused on gathering impressions of atmosphere, emotional response, and perceived comfort from residents or users of Copenhagen's historic core. While this provided rich qualitative insight into how people experience light in a context that is often praised for its human scale and sensory coherence, the study lacks a direct, resident-informed counterpart in Ørestad. This creates a gap in comparative understanding.

In Ørestad, conclusions about lighting character were drawn primarily from site analysis, article-based research, and expert interviews, rather than from the lived experiences of local users. As a result, the comparison between the two sites is asymmetrical, relying on subjective, first-hand accounts in one location and external interpretation in the other. This limits the depth of understanding regarding how residents of Ørestad perceive their own nighttime environment. Particularly how they interpret issues of comfort, safety, warmth, and spatial identity related to lighting.

To strengthen the analysis, future research should include parallel surveys in both sites, allowing for a balanced, user-cantered comparison. Questions related to lighting mood, perceived safety, spatial clarity, and emotional attachment could be addressed to residents or frequent users of Bella Park and surrounding Ørestad areas. This would not only provide a more comprehensive picture of how lighting is experienced differently in the two contexts but also ensure that design decisions are grounded in local perceptions rather than external critique.

By integrating resident feedback from both locations, the research could move beyond professional or academic interpretations and toward a more inclusive, user-driven definition of "lighting with character."

10 Chapter X: Conclusion

This thesis set out to explore how lighting (when designed with intention and sensitivity) can transform underutilized public spaces into socially vibrant, emotionally resonant environments after dark. By comparing the historically rich, pedestrian-oriented lighting strategies of Copenhagen's inner city with the spatial and perceptual shortcomings of Ørestad, this research has demonstrated that light plays a much deeper role than simply enabling visibility. It acts as a definer of mood, movement, and memory, influencing whether people choose to pass through or pause, to linger or leave.

Drawing from Jan Gehl's framework and supported by a multi-method research approach. Including literature review, expert interviews, resident surveys, site analysis, and comparative observation, the project identified how light interacts with spatial design, user behaviour, and emotional experience. The case of Bella Park in Ørestad revealed a public space struggling with vertical–horizontal imbalance, poor nighttime usability, and a lack of sensory cues. Light in this context was not absent but misaligned: spilling from facades, poorly scaled to human use, and disconnected from spatial function.

The three proposed lighting strategies: Gathering Geometry, Slowing Down with Warm CCT, and Function-Specific Lighting, respond directly to these findings. Each strategy offers a design tool to reorient space toward people rather than infrastructure, creating areas that feel welcoming, legible, and alive after dark. Together, they form a scalable, adaptable lighting framework that not only addresses specific issues in Bella Park but provides transferable insights for similar contemporary public spaces.

Importantly, the idea of lighting with character is not defined by a single bold gesture or iconic feature. Rather, it is expressed through a combination of lighting qualities that resonate with the unique spatial, cultural, and social context of a place. When light aligns with the physical and emotional character of a site, it enhances a sense of familiarity and belonging. People begin to recognize and associate specific lighting conditions with a location, which in turn fosters identity and shared understanding. Over time, these subtle but consistent qualities of light contribute to the development of a space's unique character.

Ultimately, this thesis concludes that lighting with character is not just a visual enhancement: it is a form of placemaking. When approached thoughtfully, lighting can shape how people feel, behave, and relate to urban environments after dark, turning overlooked spaces into meaningful parts of the city's collective life.

11 Chapter XI: Future Works

While this thesis has proposed a site-specific and research-based lighting strategy for Bella Park, its implications reach beyond the boundaries of a single location. The findings invite further exploration into how lighting can shape not only the physical experience of urban spaces, but also their social and emotional dimensions. Several avenues for future work emerge from this research:

Prototype Implementation and On-Site Testing

A next step would be to implement the proposed lighting strategies in Bella Park at a 1:1 scale, either as a permanent installation or a temporary pilot project. This would allow for real-time feedback, user observation, and evaluation, providing more robust data on how light affects behaviour, comfort, and spatial use during dark hours.

Long-Term User Engagement Studies

While this thesis has incorporated surveys and short-term observational methods, future research could benefit from longitudinal studies that track how people engage with the space over an extended period—both before and after the implementation of lighting interventions. Such studies would provide deeper insights into how lighting influences patterns of use, recurrence, and the development of place attachment, particularly across different seasons and times of day.

In this context, the same observational methodology used in this research could be applied at a larger temporal scale. On-site surveys and user observations could be conducted periodically, classifying activities according to Jan Gehl's categories of necessary, optional, and social activities. This recurring data collection would allow for a more nuanced understanding of how public life evolves in response to lighting changes, and whether interventions are successful in encouraging not just visitation, but meaningful, lasting engagement with the space.

Application in Other Urban Contexts

The lighting design proposed in this thesis is intended as a flexible and scalable framework, not a fixed solution exclusive to Bella Park. Its core strategies: gathering geometry, warm lighting for comfort, and function-specific illumination, can be adapted to other urban public spaces that face similar challenges, such as low nighttime usability, spatial fragmentation, or lack of identity.

Scaling the design begins with identifying sites with comparable spatial and social conditions, followed by a site-specific analysis of existing functions, circulation, and user behaviors. While each new location would require a customized lighting response, the principles and insights from this thesis provide a solid foundation for informed and human-centered design development.

To support future applications, a design guidelines document could be developed. This would compile key recommendations, spatial typologies, lighting parameters, and behavioral analysis methods into a practical toolkit for designers and municipalities. By making the approach transferable, the framework supports a broader urban agenda: using lighting as a tool to enhance public life, foster identity, and bring character to underused spaces - especially after dark.

Technical Mapping of Atmospheric Light in the Inner City

A valuable direction for future research would be to develop a more detailed and technical analysis of the lighting conditions in Copenhagen's inner city, which this thesis has so far described in more qualitative and atmospheric terms. While the current observations have captured the emotional and experiential qualities of the space, what might be described as the *intangible character of light*, a deeper understanding of its replicability depends on quantifying its physical components. This includes measuring illuminance (lux), luminance (cd/m²), correlated color temperature (CCT), spectral distribution, luminaire typology, mounting height, spacing, and beam angles. Together, these parameters make up the *visible dimension* of light, which could be captured through systematic fieldwork using lux meters, spectrometers, and photometric documentation.

When paired with subjective analysis such as user interviews, mood mapping, or perception studies, this data could offer a dual-layered understanding of lighting: the measurable and the experiential.

This comprehensive evaluation would help clarify how specific technical qualities contribute to the feeling of comfort, identity, and atmosphere in the inner city. Ultimately, this would support a more informed transfer of lighting principles to new contexts like Ørestad, ensuring that what is perceived as *lighting with character* is not only intuitively understood but technically reproducible.

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12.1 Illustration list

Figure 42: Author's Illustration
Figure 43: Author's Illustration
Figure 44: Author's Illustration
Figure 45: Author's Illustration

13 Appendix

Survey: Perceptions of Urban Lighting in Central Copenhagen

Introduction

This survey aims to explore the character of urban lighting in central Copenhagen through a combination of **quantitative** and **qualitative** methods. Quantitative questions, such as those using **Likert scales**, help measure attitudes or perceptions in a structured way. In contrast, **open-ended qualitative questions** allow respondents to express their experiences and interpretations in their own words, offering depth and nuance.

Combining both methods provides a more complete picture of how residents perceive and relate to the urban lighting around them (Creswell & Plano Clark, 2018).

Section 1: General Perception

1. **How would you describe the nighttime lighting in central Copenhagen?**
   (Open-ended)
2. **How important is urban lighting for your daily or nighttime experience in the city?**
   - Not important at all
   - Slightly important
   - Neutral
   - Important
   - Very important

Section 2: Atmosphere and Feeling

3. **What kind of atmosphere do you think the lighting in the city center creates?**
   (e.g., cozy, cold, modern, historic, mysterious, safe, functional, etc.)
   (Open-ended or multiple choice)
4. **Do you think the current lighting fits Copenhagen's identity and aesthetics?**
   - Definitely yes
   - Partially
   - Not much
   - Not at all
5. **Do you feel safe walking in the city center at night due to the lighting?**
   - Yes, completely
   - Mostly yes
   - Sometimes not
   - Not at all

Section 3: Aesthetics and Design

6. **How would you describe the design of the lighting elements (lamp posts, fixtures, etc.) in the city center?**
   (Open-ended)
7. **Do you think the lighting highlights architectural, historical, or cultural elements of the city center appropriately?**
   - Strongly agree
   - Somewhat agree
   - Slightly agree
   - Disagree

Section 4: Personal Preferences

8. **Would you change anything about the current lighting in the city center? If so, what?**
   (Open-ended)

Results on the survey
Qualitative Analysis of Survey: Nighttime Lighting in Central Copenhagen

This analysis is based on a set of open-ended responses gathered to better understand how people perceive nighttime lighting in the central areas of Copenhagen. The survey included questions on how participants describe the lighting, the atmosphere it creates, the design of lighting elements, and their vision for ideal urban lighting in three words. Below is a breakdown of key themes and insights.

This section summarizes the quantitative responses, offering insight into how residents and visitors experience the lighting design in central Copenhagen and where they believe improvements could be made.

1. How would you describe the nighttime lighting in central Copenhagen?	What kind of atmosphere do you think the lighting in the city center creates?	How would you describe the design of the lighting elements (lamp posts, fixtures, etc.) in the city center?	If you had to describe your ideal lighting for central Copenhagen in three words, what would they be?
Dimmed	Misterious, cozy, safe	Invisible	dimmed - warm
Quite ok	Cozy, higge	Oldschool	Warm, cozy, nice
Dark	Inviting	Hanging	aestheric subtle enough
Calm, structured and peaceful	Gentle, dark but also safe	Traditional and characteristic	Elegant, consistent, sustainable
Pleasant, not disturbing to human eyes. It seems a	Inviting and not harmful. Functional to the basic ne	Pretty basic	Slightly lit, inviting and careful
Fairly dim, but enough brightness levels.	Various atmospheres depending on location.	Minimalistic/simple street lights (on wire)	Safe, welcoming, exciting
Soft, warm, minimal, human-scaled, atmospheric ai	Calm and welcoming	Light poles are simple and functional . Lights are m	Subtle , minimal and harmonious
Not the best	A bohemian one	Nordic style	More warm lights
The city's streets and public spaces are gently illum	The lighting in the city center creates a calm and cc	The design of the lighting elements in the city cent	warm, aesthetic, safe
Pleasant except for the advertisement and shops li	Cosy	They are ok	As little as possible avoiding glare and keeping the lamps that move with the wind.
Soft and dimmed	Romantic	Nothing special	Soft dimmed and romantic
Warm and welcoming	Welcoming	Simple	
Low	Magic		
Eye level and be able to see the stars	Some areas is pleasant and safe, some is chaotic a	The lamp posts are in different variety, bollard are s	Warm, atmospheric, feel-safe-and-want-to-explore
Good	Safe	Simple and sometimes playful	Minimal, understated, functional
A bit dark, but cosy (hygge)	Cosy atmosphere	Old fashion	Cosy, energy-saving and smart
unpredictible		VARIABLE	minimalistic, settle and efficient
Dark	Hygge	Hidden	Dimmed

Qualitative Analysis of Survey: Nighttime Lighting in Central Copenhagen

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1. Descriptions of Nighttime Lighting

Many respondents used terms like **"dimmed," "soft," "warm," "cozy," and "safe"** to describe the existing lighting in the city center. Others noted it was "dark" or "quite ok," which suggests that while the lighting is appreciated for its subtlety, it may also be considered insufficient in some areas. A few described it as "calm, structured and peaceful," or "pleasant, not disturbing to human eyes," suggesting a design that prioritizes human-scale ambiance over intensity.

Insight: Lighting in central Copenhagen is widely perceived as intentionally low and atmospheric, aligning with Danish design values of subtlety and comfort.

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2. Perceived Atmosphere

The atmosphere created by the lighting is most commonly described as **"cozy," "hygge," "inviting," "calm," "romantic,"** and **"safe."** One response describes it as "a bohemian one," while another describes variability across different parts of the city. Overall, the lighting seems to enhance a sense of **emotional warmth and cultural identity.**

Insight: The lighting fosters a feeling of intimacy and tranquility in the public realm, supporting a nighttime environment that feels lived-in and approachable.

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3. Design of Lighting Elements

The lighting elements themselves were described as **"invisible," "traditional," "simple," "nothing special,"** or **"basic."** Many highlighted a minimalist or old-fashioned aesthetic, with fixtures that blend into the environment rather than call attention to themselves.

Insight: The design approach appears to favor **low-visibility and functional elegance**, in line with Scandinavian modernist values. This helps avoid over-illumination and visual clutter.

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4. Descriptions of Ideal Lighting (in three words)

When asked to describe their ideal lighting, respondents repeated themes like **"warm," "safe," "inviting," "cozy," "dimmed," "subtle," "harmonious,"** and **"minimal."** Many emphasized an ideal of **low-glare, energy-efficient, and user-sensitive lighting**, often invoking the emotional qualities of the space over technical specifications.

Insight: People envision urban lighting that enhances well-being and comfort without overpowering the space—highlighting a desire for **sensory-sensitive and human-centered lighting design.**

General Reflections

These responses show a consistent appreciation for **subtle, well-integrated lighting that supports the human experience** in urban public spaces. This aligns with Copenhagen's urban ethos, where lighting is not merely functional, but a key element of public space identity and comfort. The emphasis on **"hygge"** and emotional atmosphere reflects the importance of lighting in creating shared, culturally embedded experiences of place.

Do you think the current lighting fits Copenhagen's identity and aesthetics?	Do you feel safe walking in the city center at night due to the lighting?	Do you think the lighting highlights architectural, historical, or cultural elements of the city center appropriately?
Definitely yes	Yes, completely	Strongly agree
Definitely yes	Mostly yes	Somewhat agree
Definitely yes	Yes, completely	Somewhat agree
Definitely yes	Yes, completely	Somewhat agree
Partially	Yes, completely	Disagree
Definitely yes	Yes, completely	Somewhat agree
Definitely yes	Mostly yes	Somewhat agree
Partially	Mostly yes	Slightly agree
Definitely yes	Yes, completely	Strongly agree
Partially	Yes, completely	Somewhat agree
Definitely yes	Mostly yes	Somewhat agree
Definitely yes	Yes, completely	Somewhat agree
Partially	Sometimes not	Somewhat agree
Partially	Mostly yes	Somewhat agree
Partially	Mostly yes	Somewhat agree
Partially	Mostly yes	Somewhat agree
Not much	Yes, completely	Slightly agree
Definitely yes	Yes, completely	Strongly agree

1. Does the lighting fit Copenhagen's identity and aesthetics?

Responses:

- **Definitely yes:** 10
- **Partially:** 6
- **Not much:** 1

Key Takeaway:
A large majority (≈59%) of respondents feel that the current lighting in the city center *definitely* reflects Copenhagen's aesthetic and identity. This suggests that the lighting design aligns well with the cultural and visual expectations of the city. However, a significant portion (≈35%) sees room for improvement, indicating that while successful overall, the design could be more inclusive or representative of the broader urban character.

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2. Do people feel safe walking at night due to the lighting?

Responses:

- **Yes, completely:** 10
- **Mostly yes:** 6
- **Sometimes not:** 1

Key Takeaway:
Perceived **safety is high**—with over 94% of responses being either "yes, completely" or "mostly yes." Only one participant indicated occasional insecurity. This supports the idea that the city center's lighting is effective not just visually but also functionally in fostering a sense of security.

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3. Does the lighting highlight architectural, historical, or cultural elements appropriately?

Responses:

- **Strongly agree:** 3
- **Somewhat agree:** 10
- **Slightly agree:** 2
- **Disagree:** 1

Key Takeaway:
While **most respondents agree** that lighting serves a highlighting function (81% agreeing to some degree), few feel strongly about it. The dominant rating, “somewhat agree,” suggests that although the lighting might *technically* illuminate heritage elements, it does not always do so in a way that emotionally or symbolically resonates with users.

Overall Reflections

The general sentiment is **positive** toward current lighting conditions in Copenhagen’s city center. It is seen as culturally appropriate, effective for nighttime safety, and reasonably supportive of architectural storytelling. However, two areas for potential design development emerge:

- **Cultural Emphasis:** The city might benefit from more *intentional and expressive lighting strategies* that spotlight cultural landmarks with emotional or experiential resonance.
- **Identity Clarity:** Aesthetic alignment is mostly perceived as fitting, but clearer thematic or narrative lighting could strengthen this identity even more.