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Research Paper

Towards a sustainable campus-The impact of detailed physical components on the sustainable mental image. University of Mosul as a case study

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ABSTRACT

The urban milieu of a campus comprises an intricate constitution of interconnected elements that collectively shape a complex environment. The interrelationships among these elements play a pivotal role in the design of an efficient and sustainable urban framework. This study aims to elucidate the impact of specific physical factors on the visual sustainability of the urban fabric. The University of Mosul campus serves as the case study for this investigation. The research identifies and categorizes the components that influence the mental image of the campus, encompassing both built and unbuilt elements. The methodology employed integrates qualitative and quantitative approaches, utilizing a questionnaire and computer software to analyze the visual properties of the influencing factors. The findings of the study reveal that these characteristics and relationships contribute differentially to the formation of a sustainable urban image, with several factors being instrumental in enhancing and developing the visual sustainability of campus environments, both presently and in the future.

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1. Introduction

The design and spatial relationships of buildings play a crucial role in shaping urban environmental sustainability. Factors such as building form, details, height, and placement influence the microclimate within urban spaces. Incorporating human-scale elements and greenery enhances the overall quality of life and promotes sustainability by creating clear and comprehensible urban features, such as signage, landmarks, and monuments [1]. Urban form also influences the city environment, human activities, and interactions as a nexus between built elements and natural systems [2]. The urban scene (US) comprises a complex visual system of multiple elements. In visual assessment, analyzing these elements, identifying their connections, and determining the most important element are crucial for creating urban designs that cater to individuals [3]. Urban environments possess visual characteristics that reflect material and sensory concepts, where building-to-space relationships give places their identity [4]. The US evolves with time, bringing together people, activities, and physical elements [5]. A positive city image acts as a memorable attraction and a place easily recalled by all individuals. Physical elements play a critical role in defining a place's image, underscoring the importance of identifying mental image elements [6]. People's awareness of the urban environment, combined with experience, culture, and sentiment, gradually forms a perceptible image over time [7]. This study aims to determine the role of detailed physical factors influencing the visual sustainability of urban fabric, focusing on the Campus of the University of Mosul (UoM) as a case study. Components affecting the mental image formation of the campus were identified and classified, encompassing both built and non-built elements. The methodology employed qualitative and quantitative methods through surveys and computer programs. A sample of 30 participants, including professors and architectural students, viewed a 360-degree video presentation of the campus created using Depthmap software. Expert opinions highlighted the importance of this route as the focal point of the campus. Each participant was interview-

ed for half an hour to identify distinctive architectural elements, positive or negative. Finally, a gaze-tracking test using the Gazerecorder was conducted to track focus points, ensuring accurate results.

1.1 Urban scene-US and campus

US is defined as the visual organization of building elements, roads, and spaces within urban areas, forming organically through development processes or growing unintentionally [8]. The clarity of US depends on variable factors such as observer distance, lighting conditions, and weather, where the observer's field of view plays a significant role in scene perception. When visual elements are clear, individuals can form mental maps and navigate easily within the urban environment [9]. The US is considered part of the urban environment, a complex multi-element system comprising buildings, natural elements, and cultural and social aspects [10]. US forms within the urban fabric, known as a blend of building blocks representing the physical part and urban spaces representing the symbolic part, with their interconnection shaping the city structure [11]. The term "campus" was first used in the mid-18th century, initially referring to multi-functional complexes in American universities around 1774. The university campus is a distinct area encompassing a mix of buildings with various functions, including educational, service-oriented, recreational, open spaces, and student residential areas [12]. An advanced university campus is characterized by the cohesion of its components, the fulfillment of its functions, the arrangement of site locations, and the provision of urban transportation both internally and externally, with organizing its elements being critical to the success of the campus [13]. Universities are integral parts of the city's urban fabric and its key points [14].

1.2 Mental image

Kevin Lynch defines mental image as the way individuals conceive urban structure, formed by immediate sensations and memories of past experiences.

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Nomenclature

BREEAM	Building Research Establishment Environmental Assessment Method	US	Urban Scene
LEED	Leadership in Energy and Environmental Design	VSDC	All-in-one free toolset for working with multimedia

Its formation is influenced by several factors, including personal experience and daily activities. Improving urban design to fit residents' needs and perceptions is key, as mental images encompass beliefs, knowledge, and perceptions individuals hold about their surrounding environment [15]. They enhance the sense of belonging, fostering national and social identity through shared memories. Specific places can be remembered due to associations with particular events or activities. A strong mental image provides a sense of security compared to feelings of fear and disorientation when lost. Essentially, the mental image integrates the present, past, and future [16].

1.3 Visual sustainability

The term sustainability originated in the 1980s, focusing on environmental, economic, and social issues, augmented by a humanistic approach [17]. Visual sustainability entails enhancing and preserving the visual aspects of the built environment, including landmarks, public spaces, historical elements, and vegetation. This is achieved through integrating design and planning strategies that promote visually appealing and sustainable urban environments, incorporating pedestrian pathways, renewable materials, and vegetation. The goal of visual sustainability is to create urban environments that possess aesthetic, environmental, cultural, and social qualities. The visual concept refers to everything seen and elucidates the urban space with factors such as the relationship between masses and spaces, building ratios, size, density, and the relationship between elements [18]. Visual sustainability addresses urban environmental elements and emphasizes the visual realm, encompassing everything visible and perceived and extending beyond physical elements to include visual aspects through design [19]. A sustainable urban environment meets the needs of individuals without compromising the needs of future generations, minimizing environmental impact while promoting the preservation of the community's culture and history [20]. Moreover, the concept of sustainability has evolved beyond merely preserving the needs of future generations to emphasize economic, social, and environmental growth [21].

1.4 Element of US

The elements of the urban landscape are divided into structural and non-structural elements. Structural elements include urban facades, which represent the link between the interior and exterior, consisting of multiple components such as columns, blocks, balconies, mashrabiya, signage, canopies, doors, windows, stairs, and elevators [22]. Roofs include awnings that contribute to improving the urban environment and creating aesthetic integration with other elements, as well as arcades, gates, and pergolas (pergolas) that provide shaded spaces and support vertical gardening to achieve privacy and beauty [23]. Flooring consists of roads and streets used for access and movement, with a focus on pedestrian paths and sidewalks equipped with benches and plants to enhance their attractiveness, in addition to stairs and ramps that connect paths at different levels [24]. Non-structural elements include urban furniture, which is an important part of modern urban space design. It is used to improve the quality of life in cities and enhance their attractiveness. Urban furniture includes essential elements such as streetlights, which provide safety and visibility in public spaces, as well as phone booths and mailboxes, which were once commonly used and remain part of the traditional urban identity. Benches encourage social interaction and comfort in public spaces, while transport stations and trash bins provide comfort and organization in high-density areas. These elements contribute to the overall beauty of cities by adding aesthetic features such as fountains and sculptures that give places a unique cultural character [25]. Continuity among the components of the urban environment leads to the integration of urban infrastructure into a cohesive whole [26]. Events in urban spaces are divided into social, optional, and necessary activities, making it essential to understand the role of these places in people's lives for effective design and management [27]. Colors, texture, and vegetation are elements that significantly contribute to enhancing the visual and aesthetic identity of the urban environment. Colors are a powerful tool in shaping urban spaces, as they can affect individuals' psychological states through the emotional and cognitive effects they leave [28]. Texture is another important characteristic that contributes to the perception of the urban environment, as it refers to the types of surfaces and materials used in construction, which add variety and rhythm to the US. The variation of building materials from one surface to another creates sensory differences that enhance the experience of interacting with the city [29]. When studying decorative elements and the size of elements in the urban landscape, it is important to observe how these characteristics reflect cultural identity. The size of elements can define the character of a place

and enhance the sense of space. As for decoration, it reflects the culture and values of the community. It serves as a tool for expressing identity and history and may include geometric patterns or religious or social symbols that tell the story of the community [30].

1.5 The Relationships between the elements of the built environment

The relationships between elements are crucial in shaping the built environment in the US and include various types, as listed in Table 1. One of these is repetition, which is considered a compositional technique in architecture. Repetition works to generate order in the design [31]. Diversity relies on changing patterns through different movements, whether in shape, color, or materials, and is considered part of rhythm, often referred to as tonal coloring [32]. Rhythm is one of the most important methods for coordinating design, as it helps distribute elements and shapes in a way that creates a sense of movement for people [33]. Contrast refers to differences in shape or context while maintaining a similar meaning, which gives this contradiction another layer of meaning and adds further characteristics to repetition. Contrast can be achieved through color, light and shadow, scale, texture, or finishing materials [34]. Complexity represents the relationship between interconnected and intertwined elements made up of diverse parts. To understand the overall shape, one must recognize each part that represents this system, which results from the interaction between elements [35]. Harmony and coherence refer to the proximity between elements without opposition or conflict, achieving functional and visual integration [36]. Symmetry refers to the alignment of one part with another, which can be either vertical symmetry, horizontal symmetry, or rotational symmetry around a central point [31]. Deviation refers to how architectural elements shift from their primary axis, adding visual and dynamic effects that create a distinctive character in the design [37]. Rotation involves changing the direction and position of architectural elements around their axis, generating a sense of movement and visual focus toward a specific element or point [38]. Finally, similarity refers to how elements are repeated in an organized manner to form visual and structural balance, serving as a tool for creating a stable and harmonious environment [39]. Gradation, used to achieve rhythm, refers to the gradual change in colors and shapes in a rapid, sudden, or deliberate manner to convey meaning and generate contrast [30].

2. Literature review

The study by Wang (2023) focused on the visual responses of individuals when observing urban environments using eye-tracking software, which is considered an effective contribution to environmental sustainability and improving the image of urban environments through eye movement and perception of place characteristics. The study revealed that buildings and vegetation were the most discernible elements [40]. Zhang et al. (2024) examined the impact of historical urban landscapes on a sense of place identity, considering three dimensions: landscape characteristics, function, and historical-cultural significance. Results highlighted the importance of urban landscapes in shaping place identity and enhancing a sense of belonging [41]. Tahalea et al. (2022) analyzed the morphology of urban areas based on their elements to aid in their enhancement and increase tourism activities. The study employed a qualitative approach, using architectural photography to document the area with attention to detail. Findings indicated that aesthetically pleasing urban areas are economically dynamic, affected by street vendors, and enhanced by public transport, seating areas, and plants, making them comfortable places [42]. Phetsuriya and Heath (2022) discussed the local perception of street scenes, emphasizing how the physical elements perceived by residents shape street identity and character. Improving US, such as managing traffic flow, signage, visual pollution, seating areas, urban furniture decoration, artistic elements, green spaces, lighting, and bike paths, garnered similar opinions between engineers and local residents, both valuing sidewalk quality, traffic management, and increasing green spaces [43]. Metelkova et al. (2023) focused on the architectural forms of urban buildings and their impact on individual psychological comfort. Their research aimed to assess urban visual environments and the influence of architectural forms on psychological comfort, utilizing selected questionnaires to explore perceptions of aggression, homogeneity, and comfort across 334 city buildings using the Lüscher eight-color test. Results showed that decorative window frames, balconies, arches, columns on building facades, and decorative friezes added unique expressions to buildings, with green spaces playing a significant role in giving color to the city [44].

Table 1. Elements affecting the formation of the mental image.

Elements affecting the formation of the mental image		Common elements, properties, and relationships
Structural elements	Urban facades Walls Openings include windows, doors and other openings Prominent elements include columns, curtains, frames, and cornices Signs and banners on facades Balconies Canopies Shed above	Visual distinction as Color, Complexity, Usage, Size, Location Simple arrangement of elements as Rectangle, Square, Circle Continuity of the elements' arrangement Clarity of contact points
	Urban roofs Sunshade Gallery Pergola	Visual range Visual sequence Names and meanings
	Floor elements Streets Pathway Sidewalk Stairs Slop Escalators	Motor perception Directional differentiation Street openness degree Finishing materials Repetition Symmetry
Non-structural elements	Urban furniture Fountains Lighting installations Seating Public restrooms Garbage container Sculptures Booths Signboards Flower bed Taps	Vegetation cover as Trees, plants, and water bodies Ornamentation Artistic elements Rhythm Diversity Harmony and balance Deviation Rotation Contrast Sensory elements as Sound, smell, and touch
	Activities in urban space Activities in urban space Comfort Relaxation Passive Engagement Active Engagement Discovery	Shape

Table 2. Percentages of Elements Identified through Interviews with Participants.

Elements of the Urban Environment	Interview results percentages elements					
	The sixth	The fifth	The fourth	The third	The second	The first
Elements of the Assyrian Library	88%	26%	—	—	—	—
Supports the College of Dentistry	19%	37%	—	—	—	—
Elements of the College of Pharmacy Building	33%	15%	06%	—	—	—
Row of Palm Trees	78%	—	—	—	—	—
Elements of the Wall	59%	—	—	—	—	—
Faculty of Arts Building	63%	11%	52%	59%	63%	41%
Quran Sciences and Islamic Education Building	81%	04%	—	—	—	—
Elements of the College of Education, Pure Mathematical Sciences	22%	—	—	—	—	—
Tennis Playground	26%	—	—	—	—	—
Elements of the Kindergarten Building	81%	11%	19%	—	—	—
College of Pure Education Building	22%	26%	—	—	—	—
College of Computer Science Building	15%	—	—	—	—	—
Elements of the Student Center Building	59%	81%	22%	—	—	—
Elements of the Student Center Gardens	41%	19%	41%	—	—	—
Internal departments Building	33%	—	—	—	—	—
Civil Engineering Building	26%	—	—	—	—	—
Deanship building of the College of Science	26%	11%	19%	—	—	—

Latypova et al. (2021) explored how individuals understand a city's image using mind mapping methodology for study areas, conducting in-depth interviews, and social media surveys. They concluded that a city's image is formed by environmental symbols, distinctive urban elements, iconic buildings, signs, and urban spaces [45]. Maghool et al. (2020) conducted experimental studies measuring subjective and objective data to understand spatial characteristics' impact on residents' emotions, utilizing virtual reality technology and body and brain sensors. Their research identified three factors influencing emotion: visual complexity, size, and light [46]. Su et al. (2023) stated that the mental image is a person's representation of a place in their mind, embodying feelings,

sensations, and opinions expressed through visual and textual means. Their study explored methods for classifying image types to achieve a comprehensive urban image, proposing the integration of urban images with tourism to create an interactive urban system [47]. Subharun (2023) the study highlights the importance of integrating green technologies and sustainable practices in higher education, focusing on energy efficiency, waste management, and sustainable transportation. It also emphasizes the role of technologies such as the Internet of Things and green data centers, offering recommendations for developing green infrastructure and enhancing community engagement to achieve a sustainable educational system [48]. Dawodu (2022) the study

reviewed sustainability assessment tools for university campuses, highlighting the limitations of existing frameworks such as BREEAM and LEED in addressing the specific requirements of the campus context. Through bi-biometric analysis, 15 sustainability dimensions were identified, with the environmental, educational, and governance aspects being the most prominent. The findings emphasized the importance of context and the need to enhance inclusive decision-making to improve campus sustainability [49].

3. Method

The study relied on a methodology that combines 360-degree video technology and the Gazerecorder eye-tracking software, which provides heat maps showing participants' focus areas through a webcam. The goal was to identify the elements that contribute to the visual sustainability of the campus. The video path was presented to a group of professors and students from the Faculty of Engineering, Department of Architecture. Professors contributed with their practical experience and specialized insights, while students offered new ideas that helped guide the research and answer the questions posed. The ease of access for participants also facilitated data collection. The sample represented the study population, enhancing the generalizability of the results and making them measurable. The path was filmed using a Ricoh 360-degree camera, mounted on a stand at head level, with the video recorded while walking slowly and steadily. Six video clips were recorded, each lasting five minutes. The clips were processed using the Ricoh Theta camera software and edited with the VSDC Free Video Editor. The clips were shown on a projector in the Department of Architecture, where participants were asked to identify the most impactful elements, both positive and negative, and describe their characteristics to understand their role in shaping the campus's US. Following this, in-depth interviews were conducted with each participant for half an hour. To accurately test the results, Gazerecorder software was used to track eye movements. Figure 1 illustrates the type of camera and the procedures followed in the experiment.



Figure 1. Ricoh camera and conducting the test for the participants.



Figure 2. Main paths at UoM according to expert interview and Department application.

4. University of Mosul, UoM, (Case study)

UoM was chosen as a case study, consisting of a collection of buildings and spaces designed cumulatively rather than all at once. The Depthmap program was used to analyze several important pathways within the campus to identify

the most integrated routes. Additionally, expert opinions were sought, confirming the significance of these pathways. The selected pathway runs between the Dentistry Gate (A) and the Science Gate (B). Along this pathway, various buildings serve different functions, including educational, administrative, and recreational purposes. Due to the diversity of these functions, the detailed elements in the urban landscape varied, as illustrated in Fig. 2. Main paths at UoM according to expert interview and Depthmap application. The selected path is in red from the Science Gate to the Dentistry Gate.



Figure 3. Elements of the Assyrian Library.



Figure 4. Supports the College of Dentistry.

5. Result and discussion

Adding 360-degree video technology is a distinctive and effective method for identifying key elements and features within the urban environment. Following the presentation of video clips and conducting interviews, a set of elements for various locations on campus was categorized based on their characteristics and proximity into groups. Table 2 illustrates the percentages obtained from interviews with participants. The first group included elements of urban facades, among which were the elements of the first part of the Assyrian Library, represented by longitudinal openings and sloping walls. 88% of the participants referred to the first part due to the uniqueness of the Assyrian Library's elements in size, shape, and organization. 26% referred to the elements of the second part of the Assyrian Library, characterized by various materials and openings in the form of cuneiform symbols, representing a visual continuity with the rest of the library parts and the transition in design from ancient to modern. Figure 3 illustrates the elements of the Assyrian Library.



Figure 5. Elements of the College of Pharmacy building.



Figure 6. Row of palm trees.

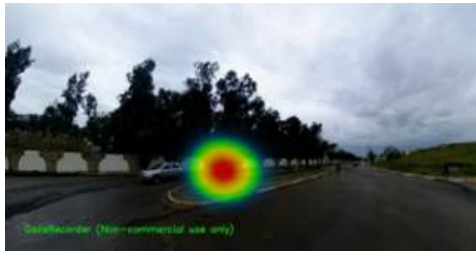


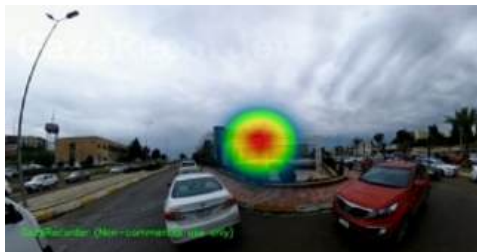
Figure 7. Elements of the Wall.



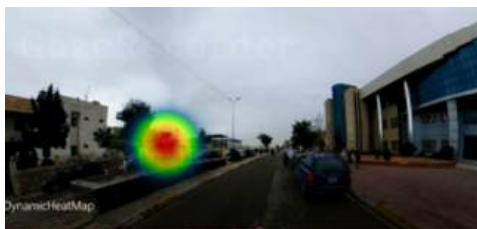
(a) View 01



(b) View 02



(c) View 03



(d) View 04



(e) View 05

Figure 8. Faculty of Arts Building.

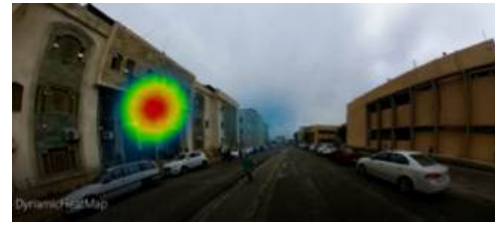
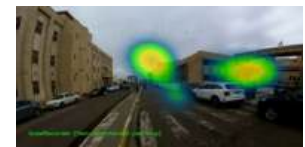


Figure 9. Element of the Department of Quranic Sciences and Islamic Education Building.



(a) View 01

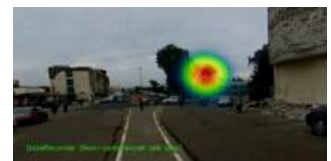


(b) View 02

Figure 10. Elements of the College of Education, Pure Mathematical Sciences.



(a) View 01



(b) View 02

Figure 11. Tennis Playground.

And 19% pointed out the details of the Dental School building due to the continuity of the design elements in the building's openings. Additionally, 37% highlighted the social interaction and student gatherings in the dental school gardens. Figure 2 illustrates the elements of the Dental School building. The participants mentioned details of the Pharmacy College building, with 33% pointing out the auditoriums due to their distinctiveness in size and measurement from the surroundings and their role in directing movement upwards. Meanwhile, 15% highlighted the openings and corridors of the building for their continuity in shaping, and 6% noted the finishing materials, particularly the differentiating white color that stands out from the context. Figure 5 illustrates the Pharmacy College building. 78% of the participants pointed to the row of palm trees along the pathway near the Dentistry Gate to emphasize visual scope, communication, and transparency without obstructing the view. Figure 5 illustrates the row of palm trees. 59% of the participants pointed to the separating wall between UoM and the Technical Institute for its continuity along the pathway and repetition of its elements. Figure 7 illustrates the elements of the wall. The participants mentioned elements of the College of Arts, with 63% of them referring to the facade elements such as columns and elevators, distinguished by a unique color compared to the surrounding environment. 11% pointed out the distinctive size of the building's gate. 52% highlighted the nearby fountains for their simple design using rectangular and circular shapes. Additionally, 59% noted the open-air theater in the building's gardens for its unique design, materials, size, transparency, and unobstructed visibility. Furthermore, 63% of the participants mentioned the layout of the College of Arts, and 41% highlighted social interaction in the building's gardens. Figure 8 illustrates the elements of the College of Arts building. 81% of the participants pointed out the distinctive element of the gate of the Quran Sciences College building, noted for its contrast with and differentiation from the surroundings in shape and materials. 4% mentioned the presence of air conditioning units on the facade, which gave a negative impression. Figure 9 illustrates the elements of the Quran Sciences College building. 22% of the participants pointed to the hallway and entrance of the Pure Education College building, Mathematics Department, noted for its unique shape and inward direction of movement. Figure 10 illustrates the elements of the building. 26% of the participants pointed out the fence of the tennis court, noted for emphasizing visual scope, visibility, and transparency. Figure ?? illustrates the fence of the court. The

participants mentioned elements of the Kindergarten building, with 81% pointing out the openings of the building distinguished by unique colors compared to the surroundings and simplicity in design using rectangular shapes. 11% mentioned the adjacent kiosk to the Kindergarten building, which visually complements the neighboring kiosks on site. Additionally, 19% highlighted the plaza adjacent to the Kindergarten building where public transportation gathers. Figure 12 illustrates the elements of the Kindergarten building. 22% of the participants highlighted elements of the Dean's Office building in the College of Pure Education, which include the repetition of vertical openings, their continuity, simplicity in design, and clear connectivity. 26% mentioned the elevated gardens of the building, directing movement and transition from lower to higher levels.



Figure 12. Elements of the Kindergarten Building.

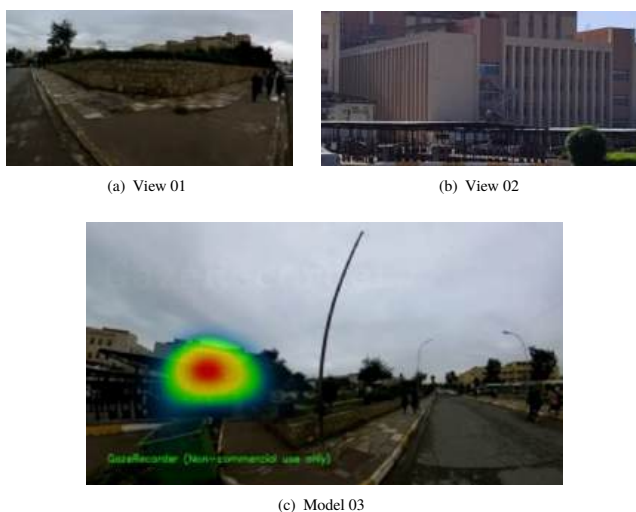


Figure 13. College of Pure Education building.

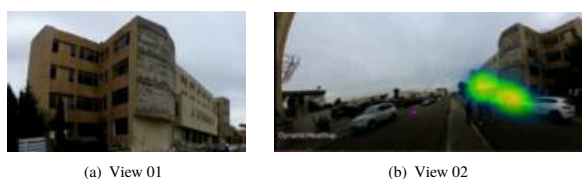


Figure 14. College of Computer Science building.

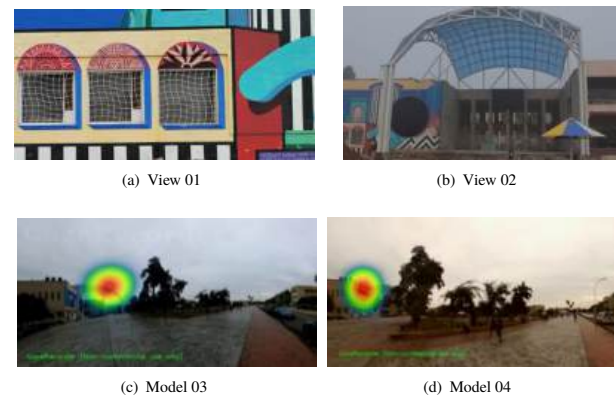


Figure 15. Elements of the student center building.



Figure 16. Elements of the student center gardens.

Figure 13 illustrates the elements of the Dean's Office building in the College of Pure Education. 15% of the participants pointed out elements of the Computer Science College building, characterized by protruding parts and inclinations that provide shading on the facades, as well as clarity in the connection points and joints between the parts. Figure 14 illustrates the elements of the Computer Science College building. The participants mentioned elements of the Student Center building, with 59% of them noting the distinctive colors of the facade that stand out from the surrounding environment, mentioning that they have a negative impact as they do not blend well with the context. 81% pointed out the dome of the Student Center, distinguished by its large size. Additionally, 22% mentioned the building's window, noted for its simple design using a circular shape. Figure ?? illustrates the elements of the Student Center building. The participants also mentioned elements of the gardens in the Student Center, with 41% of them highlighting social interaction in the gardens and the gathering of students. 19% mentioned urban furniture such as canopies, benches, and fountains, while 41% pointed out the pathways in the gardens. Figure 16 illustrates the elements of the gardens in the Student Center. 33% of the participants pointed out the openings of the internal department buildings for their simple design using rectangles. Figure 17 illustrates the internal department buildings. 26% of the participants pointed out elements of the Civil Engineering Department building, which include openings and arches interconnected with clear joints, visually perceptible. Figure 18a illustrates the Civil Engineering building. The participants mentioned elements of the Dean's Office building in the Faculty of Science, with 26% of them referring to the quality of materials used, which participants considered to have a negative impact and colors that do not harmonize well. 11% pointed out the building's gate, while 19% mentioned the openings of the building for their simple design. Figure 18b illustrates the Dean's Office building in the Faculty of Science. Sustainable urban design is crucial for enhancing the mental image of a university campus. The findings of this study hold significant implications for improving the campus environment by integrating feedback and participation from staff and users into the design process. Based on the results, distinctive elements such as urban facades, including windows and doors, can be enhanced by designing them in harmony with the campus's architectural character. This involves selecting appropriate, local, and eco-friendly building materials and colors to shape the campus identity. Additionally, incorporating elements that reflect the campus's history, culture, and local architecture fosters a sense of belonging and identity. Focusing the design on the elements highlighted in the study will promote greater attention to urban spaces, improve urban furniture to make it more comfortable and attractive, and introduce architectural features within urban spaces to enhance social interaction, such as green elements, water features, and digital screens. These findings can also guide the design of educational environments that strengthen the urban identity of educational institutions and

enrich user experiences by enhancing both tangible and intangible elements, thereby positively influencing memory and user impressions.



Figure 17. Internal departments building.



Figure 18. UoM buildings.

6. Conclusion

Understanding the process of forming mental images of urban environments is crucial for developing and enhancing the quality of the urban fabric in the future. The mental image comprises several interconnected elements with various relationships and characteristics. Physical elements intertwine with non-material elements to form the city's image, which can evoke either positive or negative impressions. Attention to detail, aesthetics, and people's preferences in urban spaces are essential for achieving sustainable urban design and a sustainable mental image. Both built and non-built elements significantly contribute to the formation of the mental image and visual suitability of campuses. Urban façades, roofs, floors, and non-built elements such as furniture and urban activities within spaces play crucial roles. Together, these elements shape how individuals perceive and interact with their environment. Combining qualitative methods, such as interviews, with quantitative techniques, such as 360-degree video and eye tracking, has proven effective in assessing the visual impact of architectural details. This methodology facilitated a comprehensive understanding of how specific elements affect perceptions of campus environments among different individuals, including professors and students. The study highlighted characteristics such as colour and texture, and elements such as vegetation cover and spatial openness as important contributors to visual sustainability. It underscores the significance of these factors in creating aesthetically pleasing and functional urban environments that support both social interactions and personal comfort. The objectives of the current study are not aimed at generalization but rather at exploring ways to enhance the urban environment of the University of Mosul campus.

Authors' contribution

All authors contributed equally to the preparation of this article.

Declaration of competing interest

The authors declare no conflicts of interest.

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Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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