

Biophilic Design Approach: Towards Better User's Urban Open Spaces Experience and Improve the Lingering Factor in the University Campus – Case study Faculty of Engineering Campus, Alexandria University, Egypt

Sagda Gamaleldin, Mohamed Ibrahim, Zeyad El-Sayad

(Assistant Lecturer Sagda W. Gamaleldin, Alexandria University, Alexandria, sagda.wael@alexu.edu.eg)
(Professor Emeritus Mohamed A. Ibrahim, Alexandria University, Alexandria, abdelallmai@alexu.edu.eg)
(Assistant Professor Zeyad M. El-Sayad, Alexandria University, Alexandria, zelsayad1@alexu.edu.eg)

1 ABSTRACT

Students spend most of their time in the university campus where they either study inside the internal spaces (lecture halls, studios,...) or in the external spaces around the campus buildings. Most universities provide well-designed external spaces inside their campus that allow students to spend their time there for any purpose they want, such as studying, waiting, or spending free time. After observing those outdoor spaces, it has been found that some of those spaces are crowded and others are abandoned at the same complex.

This study aims to find out the impact of natural elements and the biophilic approach of landscaping the outdoor university campus spaces on the students lingering and sense of the experience of such spaces. Moreover, to highlight the relation between using the biophilic approach and the livability of students' campus open spaces, a field study was conducted with several students of the Faculty of Engineering campus, Alexandria University in which the biophilic theory is applied as one of bringing nature into the space forms. It also aims to study whether this approach will affect the students' well-being and lingering factor.

Through observation, dialogues, and public questionnaires, the study ended up with several results describing the effects of implementing the theory of biophilia in the design of the campus' urban spaces. The results illustrate changes of the students lingering factors, as well as how biophilic design was affecting students' well-being and how the biophilic urbanism approach was influencing the vitality of the space.

Keywords: Lingering Factor, User Experience, Better University Campus, Biophilic Design, Urban Open Space

2 INTRODUCTION

A supportive mutual relationship is usually occurring between universities and their communities. They have a wide rich background of affecting each other's scientific, cultural, social, and economic characteristics (Ransom, 2015). Due to the escalating demand for internationalized university campuses that have a positive impact on their societies, and produce students that have flourishing characteristics of social and scientific skills, several governmental development authorities have initiated plans for higher education institutions that aimed to enhance the quality of their campuses to be more effective than just campus spaces. That corresponds to the emerging requirements of recent and futuristic university education and graduate image. This image is illustrated as the universities of the future utilizing their campus buildings, landscape, and open spaces to support comprehensive innovative learning (Abdelaal, 2019; Sidiropoulos, 2018).

On the other hand, despite the important aim and objectives of this vision, the presented actions and decisions in designing the university campuses tended to be conventional and naïve toward achieving this goal. Urban spaces, specifically in university campuses, do not provide opportunities and facilities for users to engage and participate comprehensively with each other or with nature. This is preventing the achievement of genuine social, psychological, and cognitive advantages for their users (Jan Gehl Architects, 2021).

This research explores and highlights the potential role of approaching the biophilic urbanism concepts through designing, planning, and developing the universities' urban spaces. This idea aims to stimulate students' innovative thinking process by experiencing the urban open space of their campus, as well as tracing the lingering factor variations of the urban spaces themselves. The essence of this research is to cover the gap between the lingering factor and the experiencing process in relation to the biophilic urbanism approach.

In response to this important relation, the paper explores the biophilic design values, principles, and framework. Moreover, it presents a brief vision of the characteristics of successful urban open spaces. The argument of this research is based on linking the relation and reflection of these points to each other.

Figure (1) illustrates the aim of this research, which is to analyze the implementation of biophilic design to enhance students' experience in existing university campus urban open spaces. It reflects the proposed logical framework of this research with biophilia as the first pillar, while the desirable urban open space plays the second role. The process ended up with the prospected aim and objectives of this research.

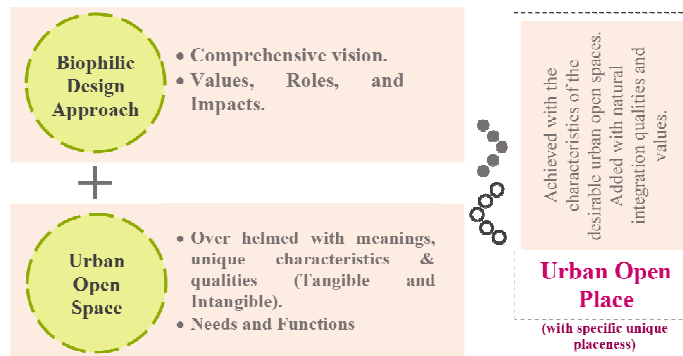


Figure 1: Research Logical Framework – between the biophilic urbanism and the characteristics of desirable campus urban space (source: author).

3 BIOPHILIA – A BRIEF OVERVIEW

Until the twentieth century, people have shown high demand for intensive contact with natural surroundings more than with urban or human-built environments. This desired context is considered as a multi-sensory surrounding, that is described by specific natural features such as light, odor, winds, sound, weather and climate, water, greenery, vegetation ...etc. (Jones, 2013). Studies have been held by a group of neuroscientists, who have considered these biological phenomena using advanced computer-added technologies for imaging, that indicated an innate human need and eagerness for experiencing natural related actions and spaces (Zari, 2019) (Biederman & Vessel, 2006).

According to Kellert & Calabrese, 2015 biophilia, has been defined as the essential, innate, tangible, and intangible biological bonds between users and nature. It has also been defined as the interpretation of human attraction towards the natural environment into an existing built environment (Totaforti, 2020). Beatley, 2011, Zari, 2019. Others have explored and illustrated the positive impact of approaching the biophilic urbanism strategies toward the urban space users and stakeholders. Essentially, it is believed that the biophilic approach is considered as the main sustainable design intervention technique, that can affect directly and indirectly the users' experience of their surroundings (Xue, et al., 2019) (Carter, Derudder, & Henríquez, 2021). The following Table 1 illustrates the direct relation between biophilia's primary tangible and intangible tools and their impact on open space users.

Tangible Experience of Nature	Intangible Experience of Nature	Experience of Urban Place
- Greenery (Natural or Manmade) - Sunlight - Winds - Water (Natural or Artificial) - Animals, & Natural/Artificial Ecosystem - Weather and Climate - Textures and Materials	- Image of Nature - Sense of Materials - Sense of Colours - Sense of Shapes, Forms, and Natural Geometries - Simulating Natural Light and Air - Biomimicry Concepts	- Sense of Protection and Safety - Sense of Organisation and Complexity - Integration of Parts to Wholes - Transition in Spaces - Mobility and Wayfinding Process - Sense of Place Cultural and Ecological Bonds

Table 1: Biophilic urbanism approach attributes and experiences (source: upgraded from (Kellert & Calabrese, 2015) (Sayed & Nagy, 2020))

3.1 Biophilia as an Approach Towards Better University Campus Urban Open Spaces

Throughout history, the relationship between humans and nature is stated as an essential fundamental need and a biological human right. It affects human presence aspects of well-being, interaction, and health (Xue, et al., 2019). Gamage, Munguia, & Velazqu (2022), have illustrated the biophilic university, in which both

buildings and campus urban spaces are enhanced through environmentally approached elements of design, as well as that the university depends on environmental literacy for developing its educational system.

The Biophilic University is a philosophical concept that reflects the essential need for university campus users and the context of being connected with nature through several aspects, which requires a radical reform of modern society. Edward O. Wilson (1984), hypothesizes that biophilia in urban open spaces is the reflection of nature in several dominant aspects through architecture and the built environment. Thereafter, the university biophilic design approach has been developed over time to use surrounding conditions and elements of nature to enhance tangible, psychological, cultural, and spiritual human wellbeing (Kellert & Calabrese, 2015) (Abdelaal, 2019).

This research tries to present sufficient evidence that the values, patterns, and attributes of the biophilic approach could be injected as catalysts to revitalize the sense of belonging, creativity, imagination, ...etc, and the capacity of campus users through the biophilic transformation of the campus urban open spaces (Gamage, Munguia, & Velazqu, 2022). A revision of selected references shows three biophilic levels of integration through the university campus urban space: indirect, incidental, and intentional. On the other hand, it could be determined that the benefits of this approach span from physical cognitive benefits to intellectual spiritual benefits. Through this research framework, it is proposed to focus on intellectual spiritual benefits and characteristics. The framework highlights the role of various values, patterns, and attributes of this design approach towards achieving this role (Xue, et al., 2019).

Kellert & Calabrese, 2015, propose nine values of the biophilic approach that can stimulate physical, emotional, intellectual, and moral benefits of students-nature relation and interaction. Naturalistic, scientific, symbolic, and aesthetic values-oriented campus design, has been suggested in their hypothesis. They believe in their substantial impact on the innovation capacity of university campus users (Table 2).

Biophilic Design Value	Description	Impact
Utilitarian	Natural functional benefits (e.g. use of natural materials and resources, ...etc).	Enhance mental, emotional, and intangible capacities (Pretty, Barton, Sellens, & Griffin, 2005).
Dominionism	The dominant desire of controlling nature (e.g., topping a peak, a dashing river...etc).	Trigger the sense of safety, freedom, monolithic, self-regard, and risk-resolving capacity (Biederman and Vessel, 2006).
Naturalism	Source of revitalization, enhancement, and diversity that raise nature integration awareness.	Developing an increasing sense of clearness, power, and peace (Windhager et al., 2011).
Scientific	A source of experimental knowledge and literacy comprehension.	Promote critical thinking, issue-solving, and mental skills (Bringslimark et al., 2007).
Symbolic	Source of imagination, connectivity, and intellect.	Enhance imagination, renovation, connecting, and intangible mental maturity (Kaplan, 2001).
Aesthetic	Inspires a sense of beauty and attraction.	Develops curiosity, exploration, imagination, and discovery.
Humanistic	Source of attachment and emotional affection	The skill of forming friendly companionship bonds, cooperation, sociability, and trust (Windhager et al., 2011).
Negativistic	To avoid the fear of nature's harmful features through aversive reaction.	A positive sense of awe, esteem, appreciation, natural modesty & repentance (Shinew et al., 2004).
Moralistic	Source of ethical and spiritual inspiration	Promote a sense of significance, spiritual assets, self-esteem and dependency, nature, and beings' unity (Jirásek et al., 2016).

Table 2: Describes the Impacts of Biophilic values on the user's skills and performance through the innovative campus approach (source: author modified from (Abdelaal, 2019) (Kellert & Calabrese, 2015))

4 LINGERING FACTOR AND THE CHARACTERISTICS OF DESIRABLE URBAN SPACE

Immanuel, et al., (2021_, and others define the desirable urban open space as a place suitable for people to achieve their requirements, activities, and anticipations. People experience the city based on its urban open spaces where engagement with the communal and social life is granted between people, space, and function simultaneously (Zakariya, Harun, & Mansor, 2014). Primarily, urban open space comprehends several characteristics that aim to sense the place, to use of space, and the settings for interaction. In the case of university urban open places, the significance of their characteristics gets more essential and crucial over time. University's desirable or successful place is identified as well through what fulfills its role and is

characterized by certain meanings, qualities, and characteristics (Project for Public Spaces, 2018) (Trencher, Terada, & Yarime, 2015) (Gehl J., 2010).

It is important to identify these physical, social, and spatial characteristics. Layout and connectivity, social and diversity; historical and interactivity are various aspects that affect their functionality (American Planning Association, 2016). Indeed, a survey of references has explored the characteristics that are considered among urban open places. CMG, PPS, and others illustrate these characteristics of desirable or, as stated by them, successful, urban open places (Gamaleldin, Al-Hagla, & El-Sayad, 2020). The research considers these characteristics from three different approaches, as follows:

(1) Public Places Through Inherent Place Approach

The RIBA (The Royal Institute of British Architects, 2018) report is a multi-associations partnership, as a precursor for future place projects by pointing up idealistic placemaking experiences around the country. It considers the 'Ten Characteristics of Places where People want to Live' approach. It highlights the relationship between the desired characteristics in a human intimate place and the design quality of each characteristic (Table 3). The report investigates a wide range of case studies. It endorses the - Letwin Review, 2018 – an approach that considers better placemaking to increase the quality and supply.

Characteristic		Quality
01	The right place for the right housing	Eligibility, Sense of belonging
02	Place to start and a place to stay	
03	Place which fosters a sense of belonging	Sense of loyalty and belongingness
04	Place to live in nature	Integration and Comfort
05	Place to enjoy and be proud of	Enjoyment and
06	Place with a choice of homes	Sense of Belonging and Comfort
07	Place where people feel at home	
08	Place with unique and lasting appeal	Distinctiveness
09	A sustainable place for future generations	Sustainability
10	Place where people thrive	Sociability

Table 3: the characteristics of desirable urban open space according to the RIBA’s report (source: author).

(2) Public Place Through Designer Approach

As an exploration, the CMG studio (2014) works on increasing the well-being of the social and ecological aspects of places, through artful design missions. A survey has been created among the CMG studio designers considering “what makes a good public space?”. The results (Figure 2) (Table 4) are based on the designers’ experiences and consist of four main types of opinion as main factors: people, delight, flexibility, and function consequently.



Figure 2: Pie chart illustrates the percentage of enrolment of public place characteristics (source (CMG, 2014))

Designer	Description	Quality
Opinion 1	Prioritize the function. Illustrates that people are the most important factor affecting the success of public space. To vital (usable), then the prosperity of the public place is granted.	Presence of People
Opinion 2	Considers a sense of place, uniqueness, safety, refuge, and attractiveness simultaneous with the occurrence of people. Provide the ability to present their needs and to attract a wide diverse range of people from several backgrounds, all are free to use space as they decide.	Flexibility, Diversity & Sense of Place
Opinion 3	The balance between safety& wonder, comfort, and risk, distinctiveness, and function. It guarantees a sense of enjoyment and delight, bringing people out of their heads following their imaginations, and engaging them with themselves, the city, and their heritage.	Delight and Function

Table 4: The CMG’s Survey Results (source: author)

(3) Public Places Through Observational Approach

Carmona (2001 & 2010), (Cattell, Dines, Gesler, & Curti, 2008), and others note that the main element is to adapt people's needs which vary regarding their culture and traditions. Through an observation process in different urban places, they have illustrated a group of principles:

- Crime control and resistance through a successful design of the public spaces.
- Provide opportunities for social interaction & vital celebration places in the place design process.
- Avoid the conflict between pedestrian movement and vehicle circulation.
- Prospering the quality of the urban open places regarding its design and control.
- The intangible & urban open space democratic concepts, that space is accessible and free for everyone.

Accumulatively, they illustrate five main principles are required to achieve a successful urban open space, which reflects that the urban open place is achieving its role in its city (Table 5)

Principal	Description
Comfort	Illustrates the linger factor as an indicator reflects people's comfort and reliefness toward a place. This principle depends on environmental, physical, psychological & social aspects related to the places or people themselves.
Meditation	The importance of the psychological aspects of a place's users. That would be achieved through providing the place with entertainment and relief elements of soft and hardscape to guarantee the balance with security issues.
Exploration	One of the main aspects that could guarantee the success of the public place. The diverse, distinctive, experimental, and trendy stimuli are required to prosper the public place.
In-Active Relationship	A supportive element leads to achieving comfort, meditation, and the needless direct folks/place interaction. Whyte (2001) explains that nothing grabs people's attention more than people themselves, thus the most vital places are those rich in pedestrians and allowing observers to watch others without eye contact.
Active Relationship	Refers to the direct intervention of people in the public place. This kind of intervention was observed by Cattell, Dines, Gesler, & Curti, (2008) as one of the most popular and substantial principles.

Table 5: The Five main aspects of a successful public place form an observational approach (source: Author upgraded from (Cattell, Dines, Gesler, & Curti, 2008))

Gehl Architects (2015) presents the 'Twelve Urban Quality Criteria' (Figure 3) that considers the important role of activities within urban open places. It provides qualities that could guarantee the invitation of all ages people, and elapse the users' sense of loss through experiencing the urban space.



Figure 3: The Twelve Urban Quality Criteria by Gehl Institution Source: (Jan Gehl Architects, 2022)

Moreover, through worldwide observations, surveys, interviews, and workshops Projects for Public Spaces PPS believes that urban open spaces must be designed by people and uses. PPS has stated four main qualities: accessibility, activities, comfortable; and sociability in The Place Diagram (Figure 4) is a comprehensive tool, that describes the characteristics of desirable urban open spaces (PPS, 2018).

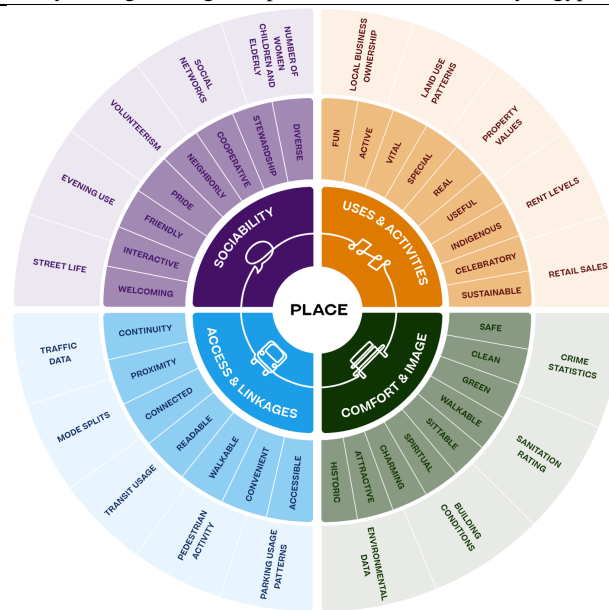


Figure 4: What makes a great place Diagram (Source (PPS Projects for Public Spaces, 2018))

4.1 Lingering Factor in Urban Open Spaces

Through the development efforts to achieve the desirable urban open space, the 'Lingering Factor' definition has been presented to the scene. PPS argued that desirable spaces could be achieved by people's presence, remaining when they have no pressing reason to stay, which has been defined next as the “lingering factor”.

The definition of lingering factor emerged, which describes the measurement and design of users' presence form, type, and shape in urban open spaces. It is observed that people's lingerness is affected by several aspects that would be analyzed and determined (PPS Projects for Public Spaces, 2016).

It is believed that the linger factor is an apparent threat that could be noticed to be apparent, in relation to the vitality of urban open space. It is inequitable to restrict urban space lingerness by this shallow perspective. It is important to study the various causes of dis-lingering urban open spaces, as well as, to develop a measurement tool for the linger factor of urban space.

As a secondary factor, PPS illustrates that the good management of urban space plays an important role in its success. This includes cleaning, offering utilities, scheduling events,..etc that could be managed by the community, individuals, or through local partnerships. It is believed that the lingering factor of urban open space is affected directly or indirectly by its main and secondary factors and characteristics (Soltanian & Mohammadi, 2015). Throughout this research, it is proposed to focus merely on the vitality as the apparent quality describing the lingering factor, despite the importance of the remaining qualities.

4.2 University Campuses' Desirable Urban Open Spaces Characteristics – Natural Integrated Focus

It is believed that the more urban spaces users are interacting with, viewing, or sensing nature, the more function enhancements occur. Thus, the naturalistic development of university campuses based on biophilic design principles could help its urban spaces to address the users' needs and functions positively, which are described through the characteristics of desirable urban open spaces. Aburas et al., (2017) illustrate accommodation and integration as essential mental requirements for university campus users. Hence, the biophilic approach to campus design offered essential changes in its settings, as well as achieving the characteristics assets of desirable urban space, which, accordingly, affects its users' perception process.

There are numerous advantages of the biophilic approach campus design to stimulate, enhance and revitalize the users' capacity of needed functions, especially as university students. Figure (5), illustrates the cognitive, psychological, and physical demands of university campus users according to four different functioned-based zones type. First, the academic units, require a stress-reductive and self-esteemed increasing environment with a sense of concentration. Second, the project units foster increasing concentration, focus, and restoring attention. Third, the imaginative groups, provide explorative, spiritual, and physical well-being, as well as an attention-increasing environment. Fourth, the creative groups, play the role of social hub that fosters

connectivity, sociability, and users/users or users/society engagement opportunities. Nevertheless, it is proposed to achieve a natural, good academic educational environment through the campus urban open spaces (Abdelaal, 2019)(Sinxadi & Campbell, 2020) (Gamage, Munguia, & Velazqu, 2022).

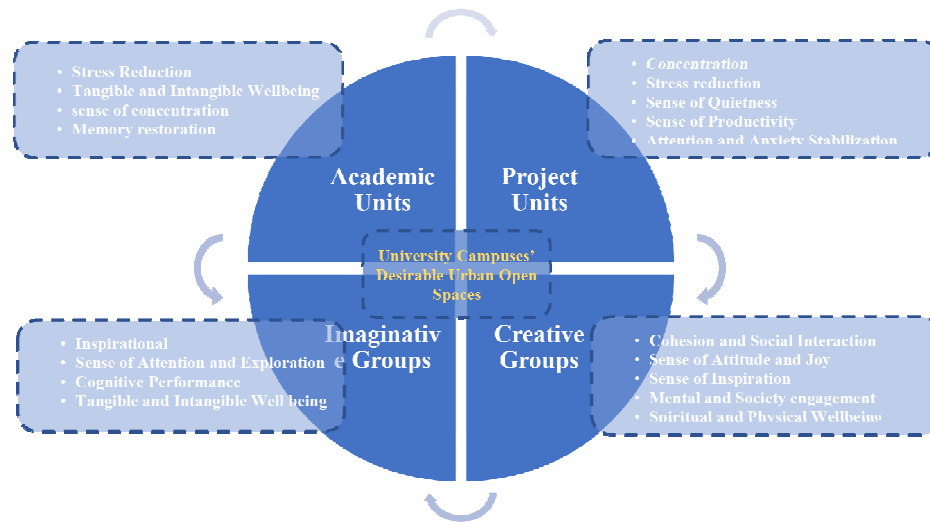


Figure 5: Biophilic Approach Impact on University Campus urban spaces units to achieve the sustainable-innovative campus (source: author upgraded from (Abdelaal, 2019))

5 THE ROLE OF BIOPHILIA TO IMPROVE THE LINGERING FACTOR OF URBAN OPEN SPACES

This research proposes that the interrelated connections between biophilic urbanism as an approach and the intervention process - of either developing or designing - the urban spaces of the university campus could be utilized and reconciled within a more effective spatial model of an innovative campus. This proposed futuristic model of campuses is believed to be the delivery tool toward achieving the characteristics of desirable urban open space through a naturalistic approach.

The following illustration (Figure 6) demonstrates a threefold pillar model that figures the interrelationship between the three main aspects of the research. First, the biophilic approach plays the role of natural stamina that drives the process of rejuvenating the urban open space. Second, the characteristics of desirable urban open space play the role of objected elements describing users' needs and functions on a university campus. Third, the lingering factor, as the apparent urban quality describes the urban space stimulating process. It is believed that through tracing the lingering factor of urban space the urban intervention process, prosperity, and decline, could be traceable and measurable thereafter.

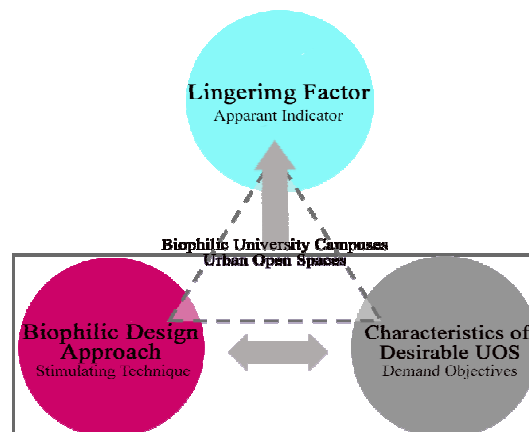


Figure 6: The Study Main Attributes (source: author)

Hence, the following model (Figure 7) combines and highlights the relation between the two action pillars of this research, biophilic and urban open space characteristics, through a mirror manner. It illustrates the overlapping end-experiencing qualities of both pillars. This framework aims to generate viable, vital, and

better university campus spaces for their users, and these campus spaces are proposed to reflect a positive increase in their lingering factor.

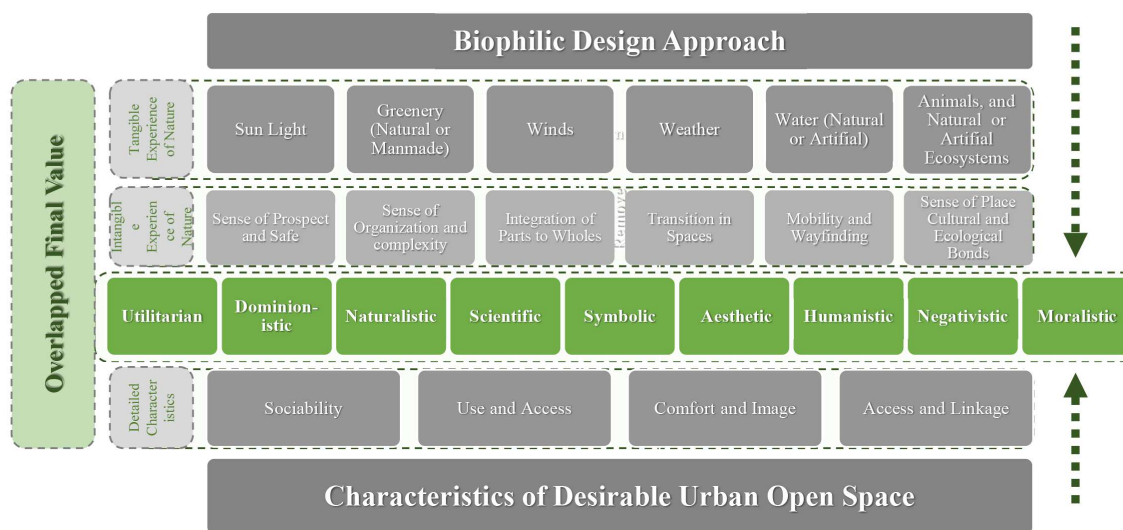


Figure 7: The Study Main Attributes Interrelationship (source: author)

The aforementioned model (Figure 7) reflects the proof of a steadily increasing body of both urban and neuroscientific research, that has considered the human body, and urban and social practices. The model highlights a noticeable connection between integration with natural processes and anxiety relief, a sense of safety, and belonging (Jan Gehl Architects, 2021; Jeon et al., 2018). Other benefits are illustrated by this model, such as stress reduction, academic performance improvement (Clayton, 2007), improved performance, and cognitive aspects (Han, 2010).

6 CASESTUDY - ALEXANDRIA UNIVERSITY, FACULTY OF ENGINEERING CAMPUS; URBAN OPEN SPACES

This study is proposed to take place at the Faculty of Engineering, Alexandria University Campus. This campus is one of the distinctive campuses all over the city. It has been established in 1941 under the command of King Fouad the First. In the light of the need for developing the quality of university education, his highness estated to design the university campus on an outstanding wide area of land, with added greenery and open spaces that are distinguished with unique greenery types and forms (Figures 8,9) (Alexandria University, 2022). Over the years, and due to several quick intervention decisions into urban planning and design of the campus, it is believed that the faculty campus conditions are not as authentic as they once were. Several space attributes have been changed, especially the greenery cover and aspects of these spaces (Figures 10, 11).

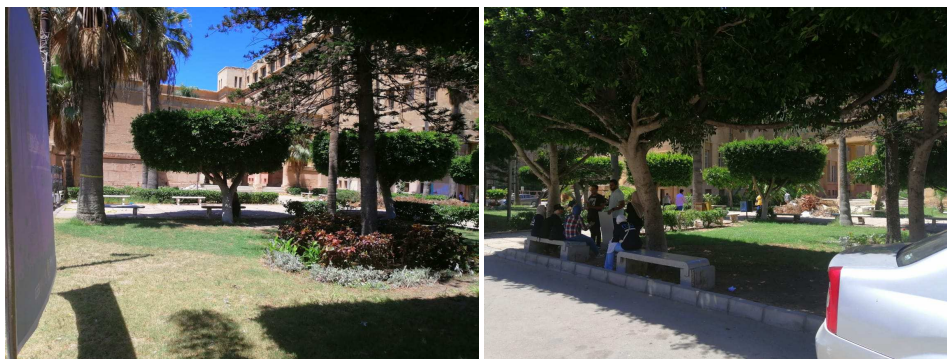


Figure 8, 9: Positive Greenery Conditions



Figure 10, 11: Negative Greenery Conditions – Either through removing or Snapping the Existing Green Cover (source: author and Salma Mohammed Photography, 2022)

This case study plays the role of a primary field survey of how the palpation of biophilic-urban characteristics are changing throughout the university campus. By observation, the researcher selected several spots of the university campus' urban open spaces according to the variations of how the users were experiencing them. The selection resulted in four different types of spaces (Figure 8).

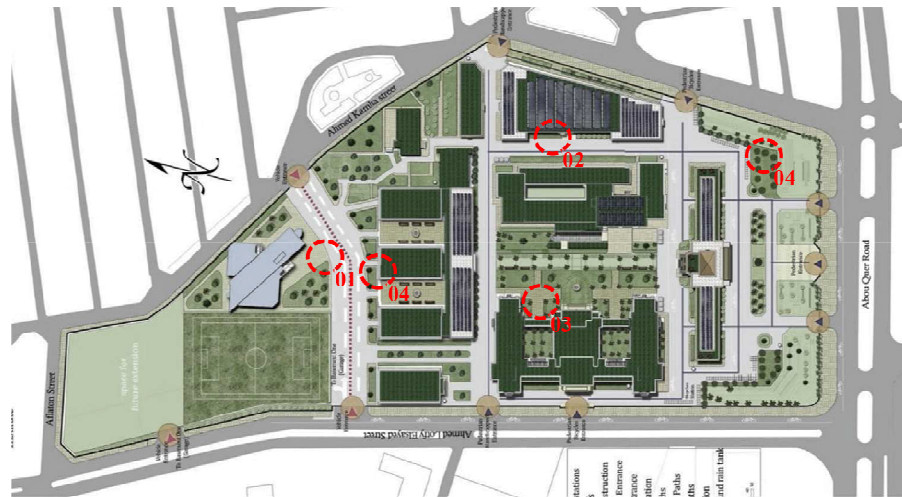


Figure 12: The Selected Spots – The Campus Key Plan Study Main Attributes (source: author, map by anonymous, verified by author, 2022)

This field survey methodology consisted of three main techniques: making dialogues with random respondents of urban place users, in-field observation, and approximate grading criteria. The dialogues took place with approximately twenty users per space. The in-field observation process was done through peak time density throughout the semester, with approximately sixty minutes per spot.

Through the dialogue, the approximate grading criteria appeared, while each respondent was asked to evaluate their own sense of biophilia and sense of desiring the urban space, as well as their willingness to stay in this urban space, as a reflection of the lingering factor from their own viewpoints. The following Table (6) is illustrating a summary of respondents' results from this field survey.

6.1 Field Survey List of Findings, Recommendations, and Further Studies

- As a process through this field survey, the researcher had the responsibility to demonstrate and illustrate the study's aspects, definitions, and dimensions for each participant, to guarantee a full understanding of this study's aim and objectives. This action has increased the biophilic/space knowledge of campus students, as well as delivered the importance of natural aspects to them, their university, and society's future.
- The field survey highlights the occurrence of strong interrelationships between the three aspects of the study.
- It is shown that the lingering factor is a reflection of the success of the biophilic urbanism approach of the campus.

- Positive results have been indicated that the users were experiencing more quality and satisfaction towards biophilic places than non-biophilic ones.
- This experiment could be expanded to cover more intensively and accurately the aspects of the research using respondent analytical questionnaires.
- It is recommended that this study could be expanded to create a comparative case study between several campuses throughout the world.

	
01	02
Biophilia ~0% ~5% Desiring	Biophilia ~1% ~10% Desiring
Lingering occurs only through an educational need. The absence of Soft/hardscape elements. Lack of amenities and natural comfort.	Lingering occurs only when buildings are needed. Disorder space usage, the absence of space definers Bad natural conditions of weather, shade, and greenery.
	
03	04
Biophilia ~90% ~95% Desiring	Biophilia ~95% ~100% Desiring
Lingering occurs almost during the length of the day. High sense of place and biophilia. Disorder space usage, the absence of space definers.	Lingering occurs throughout the day. High sense of biophilia and values of the desired place. Suitable for various types of campus units.

Table 6: Field Survey Summary Results for the Four Selected Spots (source: author, photography: author & Salma Mohammed Photography, 2022)

7 CONCLUSION

Throughout this research, numerous urban, empirical, neural, and social studies have been revealed, which illustrate the strong connection between experiencing the process of urban open space and the biophilic urbanism approach of design. First, Ulrich (1981), who has justified the increasing value of human mental & physical skills and patients' recovery rates in nature, more than in urban environments, due to the presence of natural elements. This paper illustrates that when thoughts and visions of university campuses were developed they went beyond the limited concepts of ordinary building block campuses. The study presents a brief comprehensive vision of characteristics of desirable urban open spaces perceived through different viewpoints.

The study illustrated how the interrelationship between the three main pillars of the study overlapped. A positive impact has been shown of the biophilic design approach towards the achievement of the characteristics of desirable urban open spaces, as well as the lingering factor of these spaces. Meanwhile, the

missing ring or the gap which was found in the literature was covered theoretically and supported by a brief field survey.

The primary outcomes of the proposed field survey have primarily proved the research hypothesis. Needless to mention and emphasize that this study needs to be expanded in further research by following up more intensively and by using a quantitative method for further case studies towards supporting this proposal. Finally, it could be indicated that the biophilic urbanism approach to design has shown positive results towards achieving more futuristic, social, and desirable campus urban open spaces.

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