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The Impact of Built Environment Design on Users' Psychology to Foster Pro-Environmental Behavior in University Campus Open Spaces

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Abstract

Abstract Environmental psychology is the study of the interaction between the user and the environment. This field is crucial in understanding how the built environment affects the human behavior, moods and feelings. Studying and understanding the aspects and influences of the environmental psychology is crucial key to investigate how the design can influence the human behavior to be environmentally friendly. This is known as pro- environmental behavior where the human actions are sustainable and impacts the environment positively. Accordingly, this paper aims to explore the impact of built environment design on environmental psychology to foster pro-environmental behavior in university campus open spaces. In order to achieve this, exploratory research method was conducted where a detailed study of the influences of environmental psychology was done as well as clarifying its elements. Moreover, investigating the impact of design elements on human psychology took place. Besides, an empirical study of the outdoor spaces of the British University in Egypt occurred and a survey for students and staff was distributed. The research concluded that the four main psychological aspects are mostly influenced by the following design elements colors, lighting and thermal comfort respectively. Additionally, focusing on these design elements in the design process will create a sustainable environment. As a consequence, the pro-environmental behavior of the user will be fostered.

Index terms— environmental psychology; pro-environmental behavior; sustainable environment; psychological influences.

1 Introduction

here is a powerful relation between human psychology and the surrounding environment as humans are the output of their environments. Environmental psychology is an issue that has been debated for many years to interpret the relation and understand how the environment impacts the human psychology and vice versa. Continuously, environmental psychology is the effect of the environment both natural and built on the human behavior and manners (Gifford, et al., 2011). However, in recent years more attention was directed towards the built environment to study how the design influences the behavior. Nowadays, there is a general direction to create sustainable environments for the sake of nature and human well-being. Accordingly, environmental psychologists and designers started considering how to use various design elements to foster the pro-environmental behavior. Preceding, proenvironmental behavior is an eco-friendly behavior that the human makes due to the interaction with a sustainable environment **??**Steg andVlek, 2009). Furthermore, architectural design has been used in the previous eras to affect human certain behaviors as in old religious buildings where they focused on feelings of respect and sometimes fear (Cumnings, 2012). However, today the architectural design could be used to decrease the effect of human's activities on the ecological environment and promote the sustainable behavior to create a sustainable environment. This research focuses on enhancing the user's proenvironmental behavior

in outdoor spaces of university campus through studying the influences of the built environment design on the human psychology.

2 II.

3 Literature Review a) Introduction

This section in the paper started with clarifying the environmental psychology in addition to its four main elements. Secondly, the influences of the built environment on the pro-environmental behavior are discussed where the pro-environmental behavior is a behavior chosen on purpose by the human to reduce the damaging effects of his actions on the environment **??**Steg and Vlek, 2009). Thirdly, the five main design elements that influence the user's psychology are discussed. Accordingly, this part aims to study and explain the main research topics which are environmental psychology, elements of environmental psychology, pro-environmental behavior and the design elements that influence the human psychology.

4 b) Environmental Psychology

Environmental psychology is a psychology branch that focuses on studying the relation between individuals and the surrounding physical environment (Gifford, et al., 2011). Environmental psychologists inspect the influence of the environment on human behavior and attitude (Ahu Safieh and Razem, 2017). According to Ahu Safieh and Razem (2017), to envision a human behavior, people, their desires, perception and wills should be studied as well as their surrounding environment. Moreover, this science aims to resolve issues of natural and built environment for the sake of the human's mental health and well-being.

5 i. Elements of Environmental Psychology

There are four main elements that are related to the field of environmental psychology. To start with, attention is a crucial element as to understand human behavior, the way people interpret the environment should be recognized (De Young, 1999). Furthermore, the second element is perception and cognition which is the way the human comprehend and sense the surrounding environment (De Young, 1999). Continuously, perception is a process of receiving and storing information about the surrounding environment including feelings, design and order (Gifford, et al., 2011). In addition, the third necessary element is the preferred environments where people choose the places that they feel comfortable and confident in (De Young, 1999). Besides, a sense of belonging to the surrounding environment is formed when an individual feels engaged to the surrounding and has the ability to explore it without feeling lost (Gifford, et al., 2011). Moreover, the fourth significant aspect is the environmental stress and coping which is a negative interaction between the individual and the environment (Gifford, et al., 2011). Continuously, environmental stress can be caused due to noise pollution, extreme climatic conditions and uncertainty of a place (De Young, 1999). What's more, environmental stress can affect human's health as it may cause physical illness, feeling of helplessness and tiredness (De Young, 1999). Accordingly, these elements are essential in understanding how human psychology respond to the physical environment either natural or built.

ii. Influences of the Built Environment on Proenvironmental Behavior Pro-environmental behavior is the behavior that an individual consciously does to eliminate the negative impact on the surrounding environment **??**Steg and Vlek, 2009). These influences are categorized to three main categories which are social, psychological, and physical.

a

6 . Social Influences of the Built Environment

The social context of the environment contributes greatly in shaping the behavior of the user (Cummings, 2012). In addition, people get influenced by the behavior of others easily according to previous researches (Cummings, 2012). This could be used in spreading the pro-environmental behavior among people by applying the idea that actions of other people may affect our own behavior in the design of a place. AbuSafieh and Razem (2017) stated that the design can promote human sustainable behavior by creating social cohesion in a place. For instance, there is a huge development in the information-based building systems monitoring which allows users to view and monitor building performance mainly regarding the energy use (Cummings, 2012). As a result, an interactive environment is formed between the user and the building making the user consider how he contributes in the information displayed which might lead him to act pro-environmentally (Cummings, 2012).

7 b. Psychological Influences of the Built Environment

The built environment plays a crucial role in the human behavior. So, in order to encourage proenvironmental behavior, the design should affect the user psychology positively. This could take place through the information campaigns about how their behaviors influence the environment greatly and also mention the recent environmental crisis (Cummings, 2012). Furthermore, the use of signage is effective when it contains images of how the user's behavior influences the environment (AhuSafieh and Razem, 2017). This could be effective as the signs will target the individuals' morals (Cummings, 2012). Moreover, creating a sense of belonging between the user and the

environment and making the user feel comfortable and attached to the place through design, will lead him to act in a pro-environmental manner (Cummings, 2012). To sum up, the integration of design elements that affect the user cognition as signage and creating sense of engagement will encourage him to act in a sustainable manner.

c

8 . Physical Influences of the Built Environment

The physical environment plays an important part in influencing the user behavior (AhuSafieh and Razem, 2017). Cummings (2012), states that in order to promote the pro-environmental behavior in a certain context, then the environment should be designed to encourage sustainable behavior. Therefore, an environment that promotes environmental behaviors should be designed to influence the users positively. For example, in order to reduce the energy consumption in a building, locating the stairs in a place visible and designing it with attractive designs and colors while setting the elevators relatively far from the entrance, will encourage the users to use the stairs (Cummings, 2012). Accordingly, the energy consumption will decrease which will create a sustainable environment. Additionally, encouraging users to utilize less polluting transportation means as bikes requires designing convenient areas for bikes (Cummings, 2012). This will enhance the surrounding environment. In conclusion, designing a place conveniently will foster proenvironmental behavior and create a sustainable environment.

9 c) Design Elements Affecting the User's Psychology

There are numerous design elements that impacts the human psychology which are spatial allocation, lighting, access to nature, color, indoor air quality, noise, thermal comfort, user control of space and preferred environments (Charnofsky, 2012). This research will focus on thermal comfort, natural lighting, color, spatial cognition and use of signage because they have strong influence on the human psychology and behavior.

i. Thermal Comfort Thermal comfort has a significant effect on people's behavior and well-being. It is defined as human satisfaction with the surrounding temperature, humidity and air movement (De Dear, and Brager, 2002). Continuously, taking into consideration the thermal comfort element in designing a space will influence the user's behavior and this will affect directly on the environment. For instance, a study of classroom temperature with the use of natural ventilation techniques and glazed windows showed that the students behavior improved when thermal comfort was achieved in the space (Charnofsky, 2012). Accordingly, Charnofsky (2012) suggested that the optimum temperature for learning is seventy-two degrees Fahrenheit. ii. Lighting Light is an important design element that affects user's psychology. Light includes both artificial and natural light but here the light is shed on effect of natural lighting. The natural light enhances people's feelings and mood (Charnofsky, 2012). Moreover, natural light impacts people's well-being and performance which enhances their behavior (Charnofsky, 2012). For example, a study conducted in a school classroom tested the performance of students when receiving a satisfying amount of daylight and when receiving little daylight (Charnofsky, 2012).

It was found that the students had higher test results when they were exposed to larger amount of daylight (Charnofsky, 2012). This shows the significance of integrating natural lighting in the design of indoor and outdoor spaces and how it enhances the human behavior.

10 iii. Color

Previous studies investigated the relation between the use of colors and perception as well as feeling of engagement (Charnofsky, 2012). Moreover, colors influence human manners through three elements which are hue, saturation and brightness (Kopec, 2006). In addition, hue is the wavelength of the ray, saturation is related to the purity of color and brightness is the degree of lightness or darkness of a color (as shown in figure 2) (Kopec, 2006). According to Charnofsky (2012), warmer colors are more comfortable and increase the sense of attachment to a space. Besides, colors that appear to be brighter and has higher degree of saturation gives the user pleasure and comfortable feeling. So, color represents a necessary aspect to be considered in design to boost user's manners.

11 iv. Wayfinding (Spatial Cognition)

Wayfinding is related to people's perception of a space. Users feel comfortable when they perceive a space clearly without having a feeling of being lost (Charnofsky, 2012). What's more, users become able to draw a cognitive map for the place which makes transition easier and accordingly affects their psychology positively (Charnofsky, 2012). Therefore, designing the routes and passages in a place is necessary to be clear and easy for the users as it impacts greatly their feelings and comfort.

v

12 . Use of Signage (Interactive Environment)

The use of signs in a space affects people's feeling and comfort (Charnofsky, 2012). Signs enhance the legibility in a place and makes it easier for occupants to use (De Young, 1999). Therefore, a preferred environment is created for the users which impacts their psychology and increase their sense of belonging (Charnofsky, 2012).

As a consequence, use of signs is a core design element in any space either indoors or outdoors to increase user's satisfaction.

13 Methodology and Methods

This paper adopts exploratory research methodology which utilizes mixed methods using qualitative and quantitative data. Firstly, a detailed review of the literature is conducted to investigate and analyze various design elements as well as elements of environmental psychology to enhance proenvironmental behavior. Secondly, an empirical case study is conducted in the British University in Egypt (BUE) to explore how the design elements affect human psychology and accordingly promote the proenvironmental behavior. Finally, a standardized questionnaire method is used to study how the previously discussed design elements affect users' satisfaction and behavior towards the surrounding environment. The questionnaire targets university students and staff members. Therefore, the sampling method is stratified convenient sampling technique. In addition, the males and females are almost equal in percentage. Moreover, the majority of the respondents are students as generally students use the campus open spaces with larger rate than staff members. Besides, most of students spent from 3 to 5 years in the university so they have been exposed to the campus open spaces for a long time. Furthermore, the survey was answered by 100 respondents. The majority of respondents is 18 to 22 years old (65.6 %) and some range from 23 to 27 years old (21.9 %).

Additionally, the research questionnaire is categorized into three main parts. Starting with the first part that includes demographic data about the person answering the survey. Moreover, the second part includes questions with Likert scale to rate the user satisfaction to the place surrounding in terms of design elements. However, the user will rate four environmental psychology elements which are attention, perception and cognition, sense of belonging and environmental stress and coping. Furthermore, the last part will require the user to fill a checklist of design elements with the highest impact on each psychological element from the four previously mentioned. The design elements that will be checked are color, lighting, use of signage, wayfinding (spatial cognition),and thermal comfort.

14 a) Empirical Case study

A case study of the open spaces in the British University in Egypt (BUE) was conducted. The British University in Egypt was established in 2005. It is one of the leading private universities in Egypt. It consists of twelve faculty buildings. Furthermore, the case study aim was to investigate the existence of design elements in university campus open spaces. The design elements investigated are the existence of signage, wayfinding, quantity of natural lighting, thermal comfort, and the use of colors. Moreover, the open spaces in the university campus comprise off our main categories; the food court, the roman theatre, gathering spaces between faculties' buildings and an events space in front of the auditorium. In addition, the university layout is designed in longitudinal form which makes it easy in drawing a cognition map and in the wayfinding. On the other hand, there is limited use of signs and buildings labels in the campus. Regarding the natural lighting and thermal comfort, the open spaces receive natural lighting but with limited shading devices that makes thermal environment dissatisfactory in some open areas. Furthermore, the use of warm colors on the building's facades is dominant in the campus (as shown in figure **??** and **??**).

15 Results and Finding

This part of the research will cover the results of section two and three in the survey where section two targeted testing the rate of satisfaction of the campus users with the five design elements which are use of signs, thermal comfort, natural lighting, colors and the spatial design of the campus. Moreover, section three included ranking the impact of the previously mentioned design elements on the four environmental psychology elements which are attention, perception and cognition, sense of belonging and environmental stress and coping.

16 a) Results of Satisfaction Rating

By analyzing the means of the response of the survey respondents as shown in figure 2, one may find most of the mean values of the design elements ratings range from low to high where low is from (1.8 to 2.6), moderate (2.6 to 3.4) and high from (3.4 to 4.2). Furthermore, the highest three elements are natural lighting, colors and wayfinding where M=±3.64, M=±3.58 and M= ±3.51 respectively. Moreover, the thermal comfort is below the wayfinding with mean value M= ±2.93. In addition, the least rating of satisfaction was with the use of signage where M= ±2.19 (as shown in figure 7). What's more, the survey included a why question following each satisfaction rating question to have a better understanding and interpretation of the results. The participants stated that the reason for the least rating in the use of signs is that there are no signs or very limited ones are used and this affected their satisfaction with the campus open spaces. Regarding the day lighting it has the highest ranking as mentioned before where the respondents mentioned that they are convenient with the amount of natural lighting received and it boosts their mood when leaving the building. However, additional shading devices needed to have cool shaded areas from direct sunlight. After reviewing the replies of this section, an average of the answers for each element was calculated to categorize which design element impacts each psychological aspect the least and which is the most as shown in figures **??**8 and 9). It was clear that the first

psychological element which is "Attention" the highest design element that influences it is color then natural lighting while the least is the use of signage. Secondly, the wayfinding is the top design element that impacts the "Perception and Cognition" follows it the natural lighting while the least is thermal comfort. Thirdly, the "Sense of Belonging" of the campus users is highly affected by the use of colors and follows it the wayfinding. However, the least in the ranking is the use of signage. Fourthly, "Environmental stress and cognition is influenced greatly by thermal comfort and follows it the natural lighting. On the other hand, the least design element that affects it is the use of signage. In conclusion, after calculating the mean value for all design elements to know what are the most important elements that should be taken into consideration during the design of open spaces in a university campus, it was found that colors, lighting and thermal comfort are the core design elements that should be focused on as they have large impact on human psychology and by enhancing and designing these elements correctly the user will be satisfied with the surrounding environment, the sense of belonging to the place will increase, a sustainable environment will be available and accordingly the pro-environmental behavior of the user will be fostered as shown in figure (9).

17 Conclusion, Limitations and Recommendations

This study was conducted to investigate the impact of the design of the built environment on human environment. Additionally, a discussion of the design elements that affects the user's psychology was included as thermal comfort, lighting, color, wayfinding and use of signage. Continuously, data was collected through a survey questionnaire. Findings indicate that the crucial design aspects that should be considered while designing a university open space are colors, lighting and thermal comfort respectively. By considering them a sustainable environment will be produced which will activate the pro-environmental behavior.

In conclusion, there were few limitations through the research that will be discussed to provide a better opportunity for future research. To start with, only one case study was conducted due to limited time frame. In future research, it will be useful to investigate more than one case study to analyze and compare the results. Furthermore, the sample size was limited to 100users due to time limitation. It would be useful to distribute the survey on a larger sample size while taking this paper's methodology as a pilot study and a reference to guide repetition of the empirical work. Moreover, studying a local versus an international case study would be beneficial to investigate the difference in culture and its impact on human's psychology.

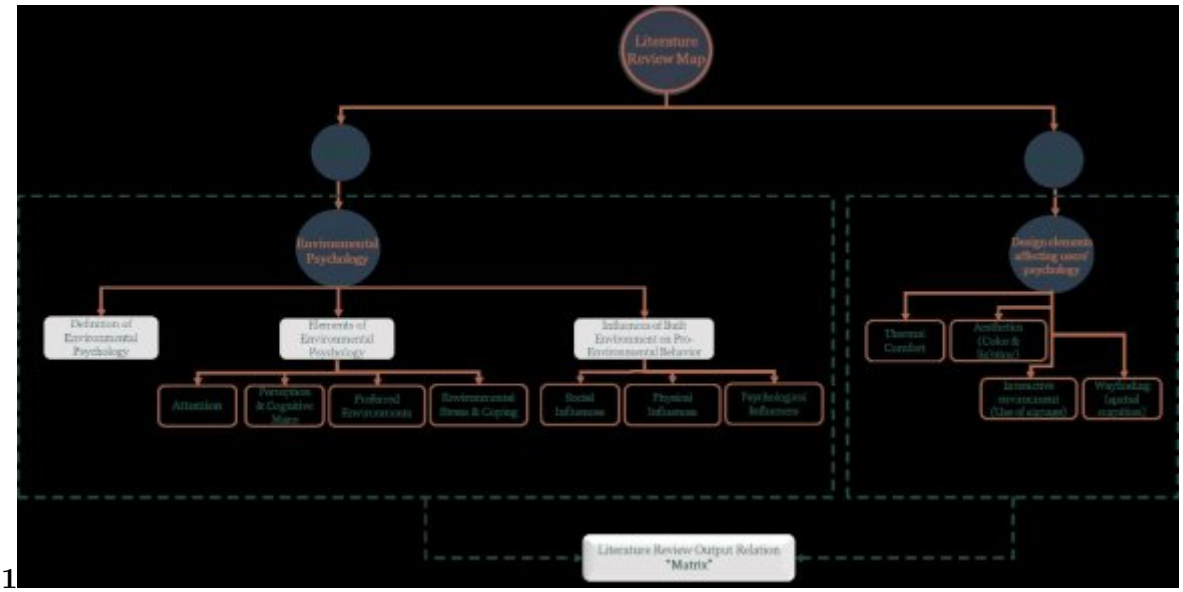

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Figure 1: Figure 1 :

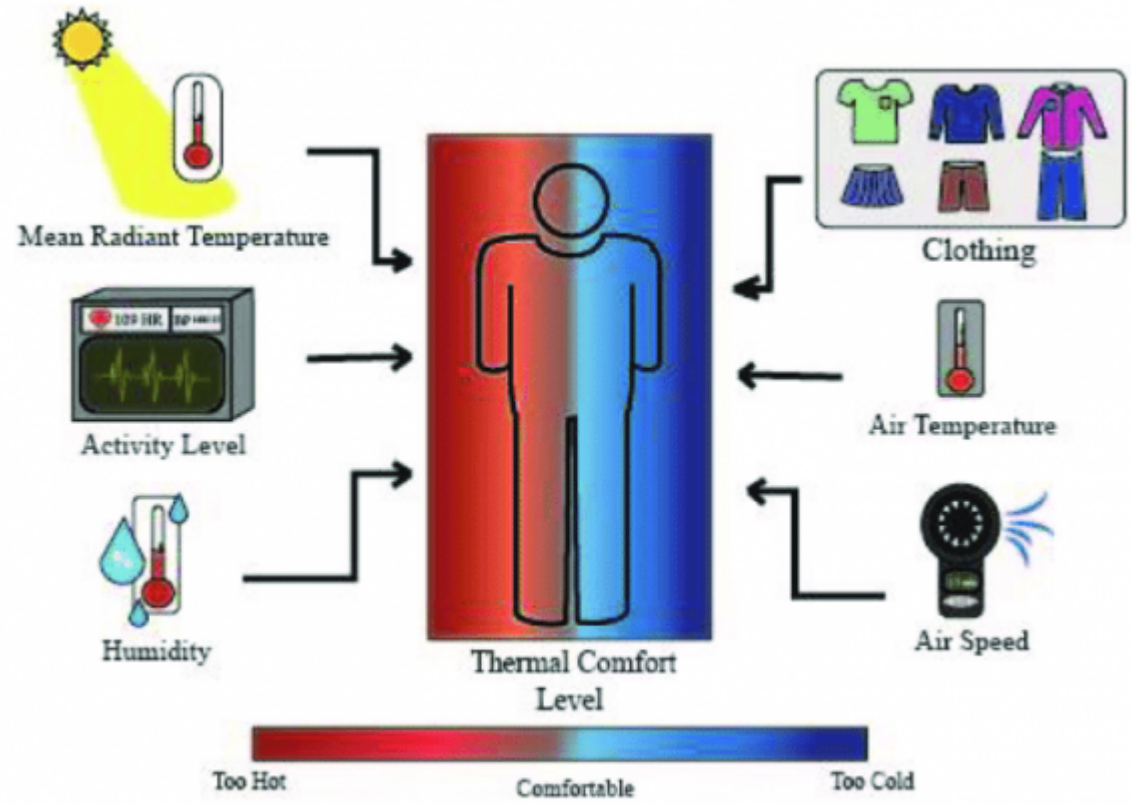

Figure 2:

1

Figure 3: Figure 1 :

2

Figure 4: Figure 2 :

3

Figure 5: Figure 3 :

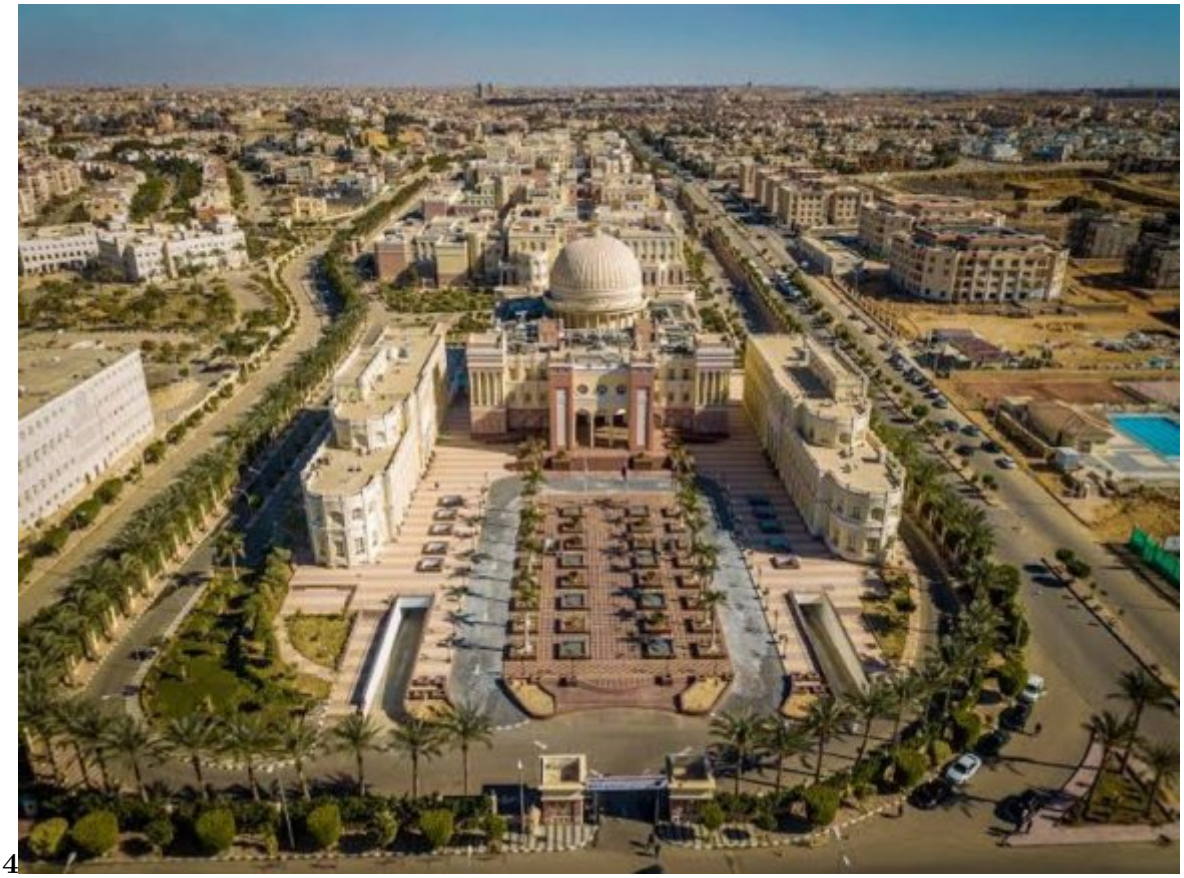

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Figure 6: Figure 4 :

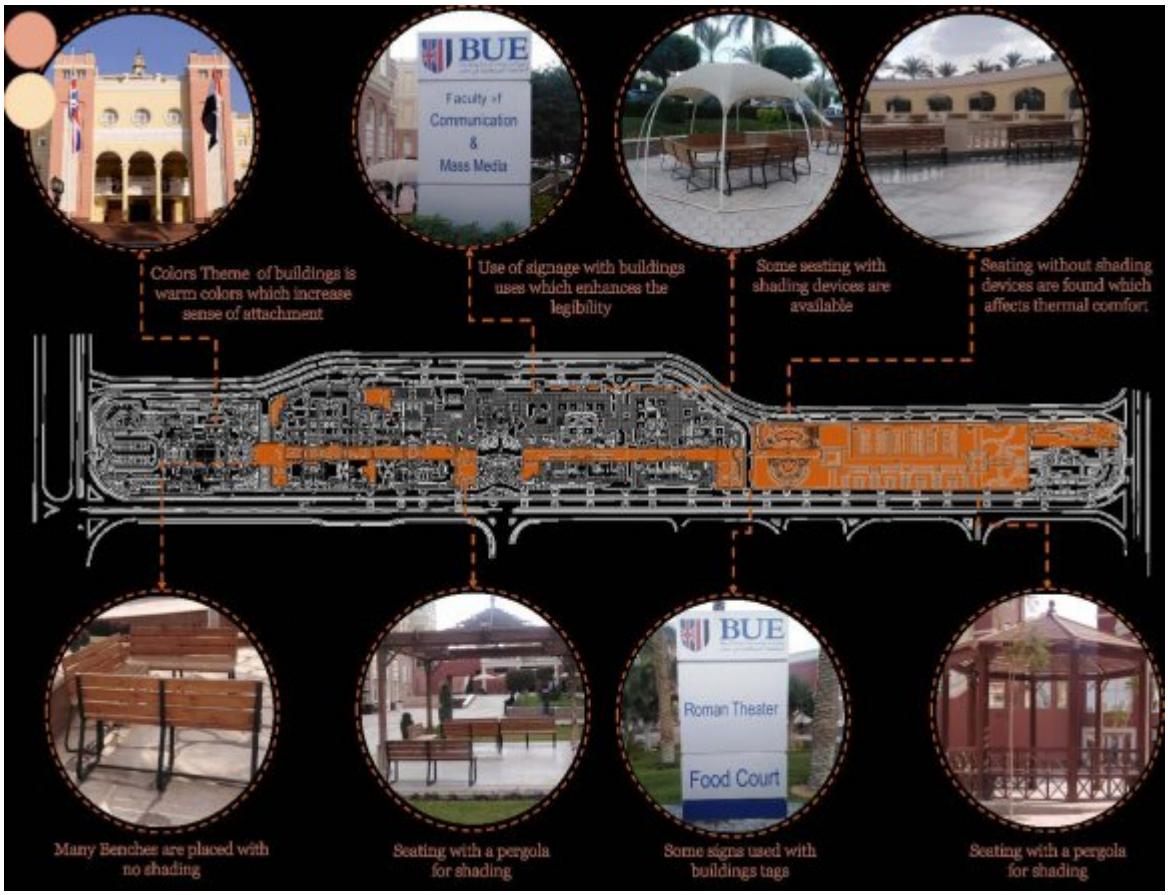
BUE
Faculty of
Communication
&
Mass Media
Colors Theme of buildings is warm colors which increase sense of attachment
Use of signage with buildings uses which enhances the legibility
Some seating with shading devices are available
Seating without shading devices are found which affects thermal comfort
BUE
Roman Theater
Food Court
Many Benches are placed with no shading
Seating with a pergola for shading
Some signs used with buildings tags
Seating with a pergola for shading

Figure 7:

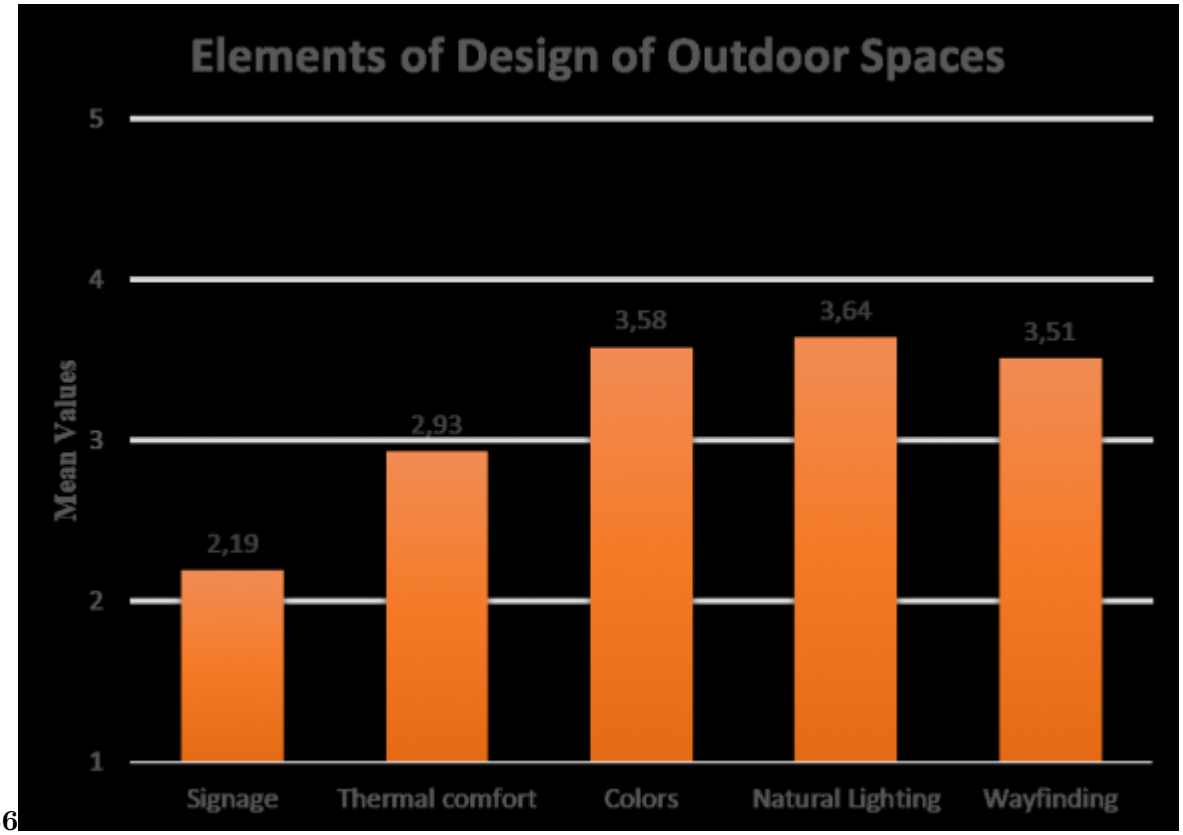

Figure 8: Figure 5 :Figure 6 :

Psychological Aspects	Attention	Perception & cognition	Sense of Belonging	Environmental Stress	
Design Elements	Colour	Wayfinding	Colour	Thermal Comfort	
	Natural Lighting	Natural Lighting	Wayfinding	Natural Lighting	
	Thermal Comfort	Colour	Thermal Comfort	Colour	
	Wayfinding	Signage	Natural Lighting	Wayfinding	
	Signage	Thermal Comfort	Signage	Signage	

Figure 9: Figure 7 :

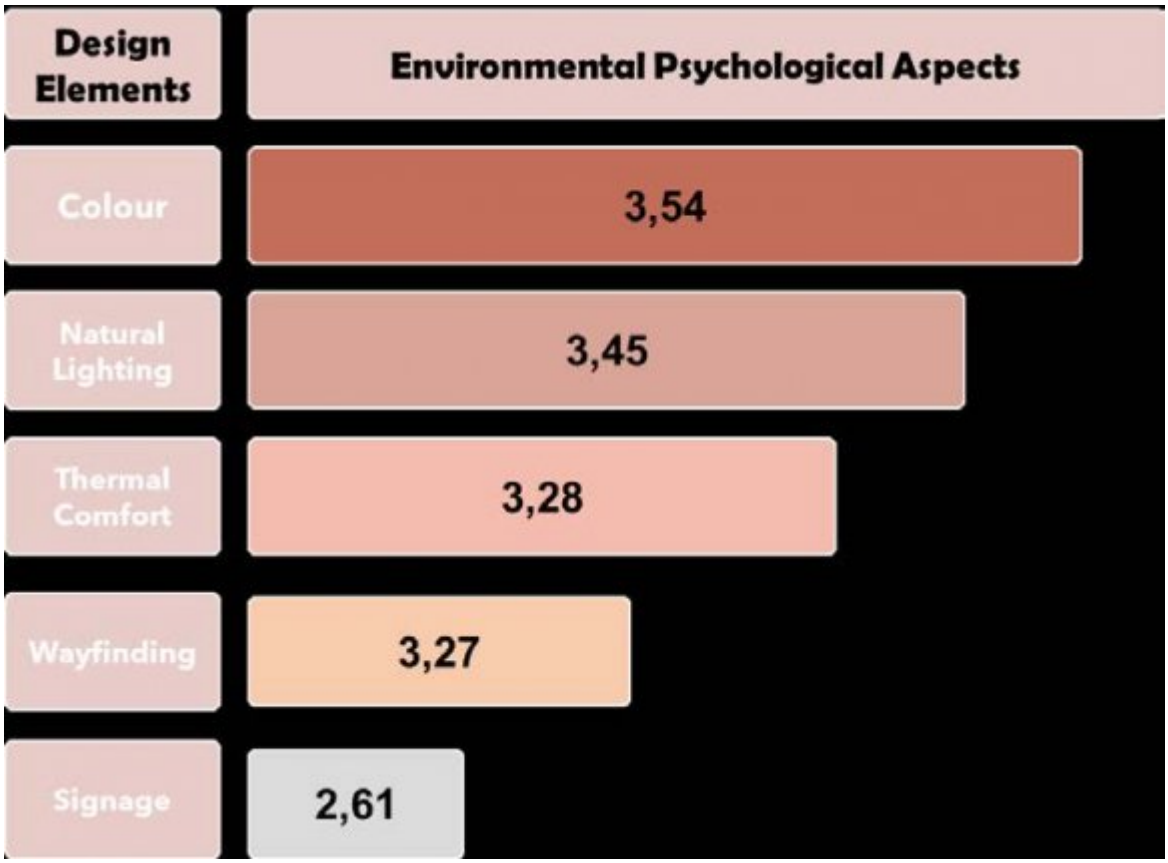
Design Elements
Environmental Psychological Aspects
Colour
3,54
Natural Lighting
3,45
Thermal Comfort
3,28
Wayfinding
3,27
Signage
2,61

Figure 10:

[De Young ()] , R De Young . 1999. (Environmental psychology)

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