



بسم الله الرحمن الرحيم

∞∞∞∞

تم رفع هذه الرسالة بواسطة / مني مغربي أحمد

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى

مسئولية عن محتوى هذه الرسالة.

ملاحظات: لا يوجد





Cairo University

**ASSOCIATION BETWEEN LANDSCAPE ATTRIBUTES
AND STUDENTS' PERCEIVED RESTORATIVENESS
AND PREFERENCE OF CAMPUS OPEN SPACES:
INVESTIGATION IN EGYPTIAN UNIVERSITIES**

By

Rana Khaled Mohamed Ahmed Shalaby

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Architectural Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2022

**ASSOCIATION BETWEEN LANDSCAPE ATTRIBUTES
AND STUDENTS' PERCEIVED RESTORATIVENESS
AND PREFERENCE OF CAMPUS OPEN SPACES:
INVESTIGATION IN EGYPTIAN UNIVERSITIES**

By

Rana Khaled Mohamed Ahmed Shalaby

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Architectural Engineering

Under the Supervision of

Prof. Dr. Mohamed Anwer Zayed

**Assoc. Prof. Dr. Marwa Adel El-
Sayed**

.....

.....

Professor of Architecture and Urban
Planning
Department of Architecture
Faculty of Engineering, Cairo University

Associate Professor of Architecture and
Urban Planning
Department of Architecture
Faculty of Engineering, Some University

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2022

**ASSOCIATION BETWEEN LANDSCAPE ATTRIBUTES
AND STUDENTS' PERCEIVED RESTORATIVENESS
AND PREFERENCE OF CAMPUS OPEN SPACES:
INVESTIGATION IN EGYPTIAN UNIVERSITIES**

By
Rana Khaled Mohamed Ahmed Shalaby

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Architectural Engineering

Approved by the
Examining Committee

Prof. Dr. Mohamed Anwer Zayed, **Thesis Main Advisor**

Assoc. Prof. Dr. Marwa Adel El-Sayed, **Advisor**

Prof. Dr. Zeinab Yousef Shafik, **Internal Examiner**

Prof. Dr. Mohamed Essmat El-Attar, **External Examiner**

- Professor of Urban Landscape Architecture – Faculty of Engineering -
Mansoura University – The British University in Egypt

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2022

Engineer's Name: Rana Khaled Mohamed Ahmed
Date of Birth: 20/5/1994
Nationality: Egyptian
E-mail: Rana.Shalaby@bue.edu.eg
Phone: 01212809353
Address: Al-Shorouk City, Cairo, Egypt.
Registration Date: 1/3/2018
Awarding Date:/....../2022
Degree: (Master of Science)
Department: Architectural Engineering



Supervisors:

Prof. Dr. Mohamed Anwer Zayed
Assoc. Prof. Dr. Marwa Adel El-Sayed

Examiners:

Prof. Dr. Mohamed Anwer Zayed (Thesis main advisor)
Assoc. Prof. Dr. Marwa Adel El-Sayed (advisor)
Prof. Dr. Zeinab Youssef Shafik (Internal examiner)
Prof. Dr. Mohamed Essmat El-Attar (External examiner)

(Professor of Urban Landscape Architecture – Faculty of Engineering – Mansoura University - The British University in Egypt)

Title of Thesis:

Association between Landscape Attributes and Students' Perceived Restorativeness and Preference of Campus open spaces: Investigation in Egyptian Universities.

Key Words:

Campus Open Spaces; Landscape Attributes; Perceived Restorativeness; Preference.

Summary:

University students are exposed to high levels of stress during their campus life events. Connection with nature has proven to reduce stress and promote mental health and well-being. However, little is known about which specific and most important attributes of landscape which have these effects, especially on a university campus. The purpose of this research is to identify the specific landscape attributes that are associated with students' perceived restorativeness and preference for campus open spaces. The findings of this research provide extra supports to the findings of literature review on restoration and preference responses, specifically for university students. It provides insights on the specific and most significant landscape attributes that influence students' perceptions that are related to their restoration and preference for campus open spaces.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Rana Khaled Mohamed Ahmed Shalaby

Date: ../../...

Signature:

Dedication

In dedication to my beloved parents, **Eng. Khaled Mohamed** and **Eng. Seham Mahmoud**, who have loved and supported me unconditionally, and taught me to work hardly and patiently for the things I aspire to achieve.

Acknowledgments

Above all, my humble thanks to ALLAH Almighty, for providing me the strength guidance, and for his numerous blessings.

This work could not have been accomplished without the continuous support of many individuals, whom I would love to extend my sincere thanks to them.

First, I would like to acknowledge and thank my thesis advisors **Prof. Mohamed Anwer**, Professor of Architecture, and **Dr. Marwa Adel**, Associate Professor of Architecture for their guidance, insightful comments, feedback, and continuous support.

Second, I must express my profound gratitude to my parents whom I dedicate this thesis to **Eng. Khaled Mohamed** and **Eng. Seham Mahmoud** for providing me with constant encouragement and unconditional love that kept me going and helped me throughout the process of researching and writing this thesis. Also, I deeply express my gratitude to my husband **Arch. Omar Geneidy** who has always believed in me, I could not ask for a better understanding, supporting and loving partner. As well as my sister **Dr. Reem Khaled** who has always helped and supported me. The accomplishment of this thesis would not have been possible without them.

Additionally, I owe my deepest gratitude to **Dr. Yomna Lotfi**, Lecturer of Architecture, who has taught me a lot, helped me with organizing my thoughts, inspired and motivated me throughout this thesis.

Last but not least, I would like to sincerely thank my friends and colleagues, especially **Arch. Noha Shaheen**, **Arch. Toka Fahmy**, **Arch. Heba El-Saay**, **Arch. Dalia Maguid**, **Eng. Doaa Mahmoud**, **Arch. Basma Abbassy**, **Arch. Zainab Tagoon**, for being there whenever I needed help or advice.

Thank you.

Table of Contents

LIST OF TABLES.....	IX
LIST OF FIGURES.....	XI
NOMENCLATURE	XV
ABSTRACT	XVI
CHAPTER 1 : INTRODUCTION	1
1.1. Research Background	1
1.2. Research Problem.....	2
1.3. Research Hypothesis	2
1.4. Research Aim and objectives.....	2
1.4.1. Aim	2
1.4.2. Objectives	2
1.5. Research Questions	3
1.6. Research Significance.....	3
1.7. Research Methodology	3
1.8. Thesis structure	5
CHAPTER 2 : CONTACT WITH NATURE AND PSYCHOLOGICAL RESTORATION.....	8
2.1. Introduction	8
2.2. Basic Definitions	8
2.2.1. Open Spaces	8
2.2.2. Psychological Restoration	9
2.3. Theories of Restorative Environments	10
2.3.1. Stress Recovery Theory.....	10
2.3.1.1. Complexity	11
2.3.1.2. Structural properties	12
2.3.1.3. Focality	12
2.3.1.4. Depth Cue/Openness	12
2.3.1.5. Ground surface texture	12
2.3.1.6. Absence of Threat.....	12
2.3.1.7. Deflected vistas.....	13

2.3.1.8. Water	13
2.3.2. Attention Restoration Theory	13
2.3.2.1. Fascination.....	14
2.3.2.2. Being Away	14
2.3.2.3. Extent.....	15
2.3.2.4. Compatibility	15
2.4. Similarities between SRT and ART	16
2.5. Measuring Method of the Environment Restorative Quality.....	17
2.6. Link between Environmental Preference and Restoration	18
2.7. Conclusion	20
CHAPTER 3 : LANDSCAPE PERCEPTION.....	21
3.1. Introduction	21
3.2. Definition of Environmental and Landscape Perception.....	21
3.3. Main Factors Influencing Human Landscape Perception	22
3.3.1. The Perceiver (Individual Factors)	23
3.3.1.1. Personal Factors Influence Individual Landscape Perception	23
3.3.1.1.1. Socio-Economic and Demographic Variables	24
3.3.1.1.2. Familiarity with the Environment	25
3.3.1.1.3. Cultural Background Variables	25
3.3.2. Situational Factors (The Context Surrounding Perception)	26
3.3.3. The Perceived Environment (The Target)	26
3.3.3.1. Perception of Landscape Components	26
3.3.3.2. Perception of Landscape Visual Elements	28
3.4. Landscape Perception Process	37
3.5. Theories of Landscape Perception and Preference	37
3.5.1. Biophilia Hypothesis	38
3.5.2. Savannah Hypothesis.....	39
3.5.3. Arousal Theory	40
3.5.4. Prospect and Refuge Theory.....	41
3.5.5. Environmental Information Processing theory	43
3.5.5.1. Coherence	46
3.5.5.2. Complexity	46
3.5.5.3. Legibility	47
3.5.5.4. Mystery.....	47
3.5.6. Summary of Key Aspects Predicted from Theories	47
3.6. Conclusion	48
CHAPTER 4 : RECENT FRAMEWORKS.....	49
4.1. Introduction	49

4.2. Perceived Sensory Dimensions (PSD)	49
4.2.1. Sensory Dimensions of PSD Framework	50
4.2.1.1. Nature	50
4.2.1.2. Culture	50
4.2.1.3. Prospect	50
4.2.1.4. Social	51
4.2.1.5. Space	51
4.2.1.6. Rich in Species	51
4.2.1.7. Refuge	51
4.2.1.8. Serene	52
4.3. Biophilic Design	55
4.3.1. Dimensions, Elements and Attributes	56
4.3.1.1. Organic/Naturalistic Dimension	58
4.3.1.2. Place-Based/ Vernacular Dimension	62
4.3.2. Biophilic Design Patterns	65
4.3.2.1. Nature in the Space	65
4.3.2.2. Natural Analogues	69
4.3.2.3. Nature of the Space	70
4.3.3. Synthesis of Biophilic Design Models	72
4.4. Landscape Visual Concepts Framework	80
4.5. Conclusion	86
CHAPTER 5 : EMPIRICAL STUDY - METHODS	87
5.1. Introduction	87
5.2. Research Design	87
5.2.1. Study Aims and Objectives	88
5.2.2. Proposed Conceptual Framework	88
5.2.2.1. Constituents Variables of Conceptual framework	88
5.2.2.1.1. Independent Variable	88
5.2.2.1.2. Dependent Variables	92
5.2.2.1.3. Mediating Variables	92
5.2.2.1.4. Moderating Variables	93
5.2.3. Sampling Design	94
5.2.3.1. Experts' Sampling Technique	94
5.2.3.2. Students' Sampling Technique	94
5.2.4. Study Areas	95
5.2.4.1. Background of the Selected Study Areas	97
5.2.4.1.1. The American University in Cairo (AUC)	97
5.2.4.1.2. Misr University for Science and Technology (MUST)	103
5.2.4.1.3. Cairo University (CU)	108
5.2.5. Data Collection Methods	113
5.2.5.1. Field Surveys and Observations	114
5.2.5.2. Survey Questionnaires	114
5.2.5.2.1. Experts' Survey Questionnaire	114

5.2.5.2.2. Students' Survey Questionnaire	116
5.2.6. Data Analysis Strategy	119
5.2.6.1. Analysis of Experts' Survey Questionnaire.....	120
5.2.6.2. Analysis of students' Survey Questionnaires	120
5.3. Conclusion	120
CHAPTER 6 : EMPIRICAL STUDY – RESULTS AND DISCUSSION	122
6.1. Introduction	122
6.2. Survey Questionnaires Findings	122
6.2.1. Findings of Experts' Survey Questionnaire.....	122
6.2.1.1. Participants' Socio-Demographic characteristics	122
6.2.1.2. Rating of the Indicators of Landscape Attributes	123
6.2.1.3. Identification of the Most Important Landscape Attributes	131
6.2.2. Findings of Students' Survey Questionnaire	138
6.2.2.1. Participants' Socio-Demographic characteristics	138
6.2.2.2. Familiarity with the Study Areas.....	140
6.2.2.3. Activities Practiced During Visits	141
6.2.2.4. Perceived Landscape Attributes	143
6.2.2.4.1. Perceived Landscape Attributes at the American University in Cairo	143
6.2.2.4.2. Perceived Landscape Attributes at Misr University for Science and Technology	148
6.2.2.4.3. Perceived Landscape Attributes at Cairo University	151
6.2.2.5. Perceived Restorativeness and its Related Components	156
6.2.2.5.1. Perceived Restorativeness of the American University in Cairo	156
6.2.2.5.2. Perceived Restorativeness of Misr University for Science and Technology	160
6.2.2.5.3. Perceived Restorativeness of Cairo University	165
6.2.2.6. Potential Relationships between the Perceived Restorativeness, its Components and preference	170
6.2.2.7. Association between Landscape Attributes and the Indicators of the Four Restorative Components.....	172
6.2.2.8. Association between Landscape Attributes and Preference	178
6.3. Discussion	179
6.3.1. Discussion of Experts' survey Questionnaire.....	179
6.3.2. Discussion of Students' Survey Questionnaire	181
6.3.2.1. Socio-demographic Characteristics, Familiarity and Activities Practiced	181
6.3.2.2. Perception of Landscape Attributes at the Three Study Areas	181
6.3.2.3. Students' Perceived Restorativeness and Preference at the Three Study Areas	188
6.3.2.4. Potential Relationships Relevant to Students' Perceived Restorativeness and Preference	189
6.3.2.5. Landscape Attributes Influencing the Four Restorative Components, and Preference in Selected Universities	189

6.4. Conclusion	196
CHAPTER 7 : CONCLUSIONS AND RECOMMENDATIONS	197
7.1. Introduction	197
7.2. Main Findings of the Research.....	198
7.2.1. Group 1: Primary Significance Landscape Attributes.....	199
7.2.2. Group 2: Secondary Significance Landscape Attributes.....	200
7.2.3. Group 3: Tertiary Significance Landscape Attributes.....	201
7.2.4. Group 4: Quaternary Significance Landscape Attributes.....	202
7.3. Research Limitations.....	203
7.4. Recommendations.....	204
7.4.1. Recommendations for Architects and Landscape Designers	204
7.4.2. Recommendations for Future studies	206
REFERENCES	207
APPENDIX A: EXPERTS' SURVEY QUESTIONNAIRE	218
APPENDIX B: SAMPLE OF STUDENTS' SURVEY QUESTIONNAIRE	228
APPENDIX C: COMPONENTS MATRICES OF THE 6TH RUNS OF FACTOR ANALYSIS	238
APPENDIX D: FINDINGS OF MULTIPLE LINEAR REGRESSION ANALYSIS	245

List of Tables

Table 1.1: Link between research objectives and research methods	4
Table 3.1: Main landscape visual elements that affect perception	29
Table 3.2: The Preference Model: Understanding- and Exploration Framework	45
Table 3.3: Summary of landscape key aspects and their relation to landscape perception theories	47
Table 4.1: Summary of Perceived Sensory Dimensions	52
Table 4.2: Description of the attributes of Environmental Features.....	58
Table 4.3: Description of the attributes of Natural Shapes and Forms.....	59
Table 4.4: Description of the attributes of Natural Patterns and Processes.....	60
Table 4.5: Description of the attributes of Light and Space.	61
Table 4.6: Description of the attributes of Place-Based Relationships.	63
Table 4.7: Description of the attributes of Evolved Human-Nature Relationships.....	64
Table 4.8: Synthesis of Biophilic Design Models	74
Table 4.9: Summary of the landscape visual concepts, their definition, dimensions in an urban context, and indicators.....	81
Table 5.1: Identified Landscape Attributes	89
Table 5.2: Summary of identified landscape attributes with their relevant indicators...	91
Table 5.3: Perceived Restorativeness Scale Items, and Statements	93
Table 5.4: Selection criteria of study areas.....	96
Table 5.5: Structure of Experts' survey questionnaire	115
Table 5.6: Structure of students' survey questionnaire	117
Table 6.1: Findings of experts' sample socio-demographic characteristics	122
Table 6.2: Results of naturalness indicators ratings	124
Table 6.3: Results of complexity indicators' ratings	125
Table 6.4: Results of coherence indicators' ratings.....	126
Table 6.5: Results of legibility indicators' ratings	126
Table 6.6: Results of ephemera indicators' ratings	127
Table 6.7: Results of imageability indicators' ratings.....	127
Table 6.8: Results of openness ratings	128
Table 6.9: Results of mystery ratings	128
Table 6.10: Results of prospect ratings	129
Table 6.11: Results of refuge ratings.....	129
Table 6.12: Classification of variables after the first run	131
Table 6.13: Classification of variables after the second run.....	132
Table 6.14: Classification of variables after the third run	133
Table 6.15: Classification of variables after the fourth run.....	134
Table 6.16: Classification of variables after the fifth run.....	135
Table 6.17: Evolution of results throughout the six runs	136
Table 6.18: The most influential variables on students' psychological restoration	136
Table 6.19: Findings of participants' socio-demographic characteristics of the in the three study areas.	138
Table 6.20: Results of activities practiced in the three study areas.....	142
Table 6.21: Results of naturalness indicators' ratings at AUC.....	143
Table 6.22: Results of complexity indicators' ratings at AUC.....	144
Table 6.23: Results of coherence indicators' ratings at AUC	145
Table 6.24: Results of imageability indicators' ratings at AUC.....	145

Table 6.25: Results of legibility indicators' ratings at AUC	146
Table 6.26: Results of naturalness indicators' ratings at MUST.....	148
Table 6.27: Results of complexity indicators' ratings at MUST.....	148
Table 6.28: Results of coherence indicators' ratings at MUST.....	149
Table 6.29: Results of imageability indicators' ratings at MUST.....	150
Table 6.30: Results of legibility indicators' ratings at MUST	150
Table 6.31: Results of naturalness indicators' ratings at CU	152
Table 6.32: Results of complexity indicators' ratings at CU	152
Table 6.33: Results of coherence indicators' ratings at CU	153
Table 6.34: Results of imageability indicators' ratings at CU	153
Table 6.35: Results of legibility indicators' ratings at CU	154
Table 6.36: Results of being away indicators' ratings at AUC	157
Table 6.37: Results of fascination indicators' ratings at AUC	158
Table 6.38: Results of extent indicators' ratings at AUC.....	158
Table 6.39: Results of compatibility indicators' ratings at AUC	159
Table 6.40: Results of preference ratings at AUC.....	159
Table 6.41: Perceived restorativeness mean values according to socio-demographic characteristics and frequency of visits at AUC	160
Table 6.42: Results of being away indicators' ratings at MUST	162
Table 6.43: Results of fascination indicators' ratings at MUST	162
Table 6.44: Results of extent indicators' ratings at MUST	163
Table 6.45: Results of compatibility indicators' ratings at MUST	163
Table 6.46: Results of preference ratings at MUST	164
Table 6.47: Perceived restorativeness mean values according to socio-demographic characteristics and frequency of visits at MUST.....	164
Table 6.48: Results of being away indicators' ratings at CU	166
Table 6.49: Results of fascination indicators' ratings at CU.....	167
Table 6.50: Results of compatibility indicators' ratings at CU	167
Table 6.51: Results of extent indicators' ratings at CY.....	168
Table 6.52: Results of preference ratings at CU.....	168
Table 6.53: Perceived restorativeness mean values according to socio-demographic characteristics and frequency of visits at CU	169
Table 6.54: Values of correlation coefficients.....	170
Table 6.55: Correlation between perceived restorativeness, its components, and preference	171
Table 6.56: Summary of landscape attributes that affect the four components of perceived restorativeness, their indicators, and preference	Error! Bookmark not defined.
Table C.1: Component Matrix of 1 st Run.....	238
Table C.2: Component Matrix of 2 nd Run	240
Table C.3: Component Matrix of 3 rd Run	241
Table C.4: Component Matrix of 4 th Run.....	242
Table C.5: Component Matrix of 5 th Run.....	243
Table C.6: Component Matrix of 6 th Run.....	244
Table D.1: Findings of being away indicators regression analysis	245
Table D.2: Findings of fascination indicators regression analysis	246
Table D.3: Findings of extent indicators regression analysis	248
Table D.4: Findings of compatibility indicators regression analysis	250
Table D.5: Findings of preference regression analysis.....	253