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Conservation of Architectural Heritage

A Culmination of Selected Research Papers from the Second International Conference on Conservation of Architectural Heritage (CAH-2), Egypt 2018

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Foreword

Conserving our heritage is a challenge that faces the world as we know it. With technology and the spread of urbanism, modernism erases the past's complexions with its rich taste and prevailing presence. The remaining traces of culture are subjected to the threat of fading away amidst the present's call for simplicity and surreal human drives.

Before beginning to read this book, readers should be aware that architecture is a reflection of the cultivated nature of its era; it is a form of art that should be preserved for generations to come. Inner-generational equity is a concept that should be taught to people of all ages and adopted by leaders. The relationship between the citizens and their surroundings can tell the story of nations better than history books; thus, the restoration of aging buildings can preserve the uprising of a nation or its downfall.

This book discusses researchers' conscious efforts to maintain what is left from the past. Variety of contentions occur as the consequences of the poor preservation of architecture; the design of public transportation vehicles is one of the issues that are discoursed throughout the course of the book. Proposing educational methodologies in order to raise awareness and cultivate people on the importance of upgrading local laws is an essential step that is also taking a vast portion of the dialog in the research papers.

Being a culmination of the best, selected research papers submitted to the international conferences on "Conservation of Architectural Heritage (CAH)," the authors of this book were given the chance to converse, debate, and learn from some of the largest names in the field of architecture who helped them develop their research papers into what they are today.

Having gone through a meticulous peer-review process, each chapter in this book is innovative and has been regarded as a distinguished piece of literature submitted to the aforementioned conferences.

Cairo, Egypt — Mourad Amer

Preface

For centuries, history has been humankind's guide to the wonders of the past that ultimately shape our present and our future. History is portrayed in many shapes and forms including books, music, clothes and materials, pottery, fossils, old pictures or movies, and many more. One of the very influential ways we have learned about our history is through architectural heritage as architecture has been a witness of some of the greatest civilizations this world has ever seen. In the form of buildings, towers, statues, and monuments, architecture has delivered historical information from one generation to another.

This book sheds light on the importance of protecting the built environment and conserving local traditions by providing the reader with a multitude of ways to achieve this goal. It provides a number of educational methodologies that are valuable to academics who are looking to update their knowledge and to practitioners who are constantly seeking improved techniques to handle architectural heritage.

The book is made of a group of the highest quality research papers submitted to an international conference named "Conservation of Architectural Heritage," which makes it a culmination of important sources that are needed in the field of research in development. Scholars, academics, students, professors, and researchers are encouraged to take advantage of this book in terms of learning from and building on all the information available.

A special mention should be made to the editors of this book and to all the authors and co-authors of the chapters who collectively provided the academic community with unique and increasingly valuable literature.

Acknowledgements We would like to thank the authors of the research papers that were chosen to be added to this book. We would also like to thank the scientific committee of reviewers who helped us select these papers and the editors of this book. Lastly, special thanks go to the IEREK team for supporting the publication of the best research papers submitted to the conference.

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Contents

About the Editors

Dean Hawkes is a British architect and an award-winning academic. His career combines practice, teaching, and research. He has received a number of awards for both academic and professional work, with the most recent one being the RIBA Annie Spink Award for Excellence in Architectural Education in 2010. In 2002, he was awarded the Leverhulme Emeritus Research Fellowship to study "The Environmental Function of Architecture." He has had several books published, including "The Environmental Tradition: Studies in the Architecture of Environment and the Selective Environment: An Approach to Environmentally Responsive Architecture." In addition, he has published a number of essays on architecture with contributions to many journals, including the Architects' Journal and the Architectural Review. Professor Hawkes is the Series Editor responsible for book proposals submitted in the field of City Identity, and Approaches to Conservation of Architectural Heritage.

Hocine Bougdah has over 25 years of experience in the field of Architectural Technology and Environment. Professor Bougdah's teaching and research interests are focused on the technological, ecological, and human aspects of architectural design. His research interests cover topics such as sustainable design, innovative low-tech, low-energy, low-impact buildings, the spatial experience of users and the issues of culture, urbanization, and globalization. He is currently working on a number of research projects on the following topics: ultra-low energy housing, communication and workflow in the design process, immateriality in architecture (exploration of the user's spatial experience, climate change adaptation through community-driven initiatives in the Global South, and the relationship between culture and space in the post-colonial architecture of Algeria. Professor Bougdah is the Series Editor responsible for book proposals submitted in the field of City Identity, Heritage and Sustainable Development.

Federica Rosso currently holds a position as postdoctoral researcher at Sapienza University of Rome, Italy. During her Ph.D. thesis, she spent an academic year as visiting research scholar at the Department of Civil and Urban Engineering of New York University Tandon School of Engineering in USA. She won, together with other Italian researchers, an award for Italy at the 4th International Conference on Countermeasures to Urban Heat Island in Singapore, 2016. She has published more than 10 papers and chapters in the field of architecture, and her most recent work being a chapter called "A Cost-Effective Human-Based Energy-Retrofitting Approach" and an article titled "New cool concrete for building envelopes and urban paving: Optics-energy and thermal assessment in dynamic conditions." Her main research interests include energy efficiency, sustainable architecture, sustainable development, solar and green buildings, energy conservation and construction technology, as well as innovative materials and construction elements for buildings and urban environment. Dr. Rosso is the Series Editor responsible for book proposals submitted in the field of Alternative and Renewable Energies in Architecture and Urbanism.

Nicola Cavalagli graduated from the Civil Engineering department at the University of Perugia on July 19, 2005, after discussing his thesis entitled "Nonlinear analysis and stability of cable-stayed antennas" supervised by Prof. V. Gusella. He obtained his Ph.D. in Civil Engineering on February 19, 2009, with the dissertation titled "Masonry resistance domain through homogenization techniques," tutored by Prof. V. Gusella. From March 2009 to March 2011, he received 2 research grants for 12 months, each carrying out research activities under the project entitled "Homogenization of materials." From May 2011 to April 2012, he received a 12-month Research Grant from the Umbria region. The research activity was carried out at the Department of Civil Engineering in the Environmental University of Perugia within the project entitled "Development of an integrated software package (Digital Image Processing/Micro-mechanics) for the protection of historical and monumental goods." From October 2012 to September 2017, he is a Determined Time Researcher at the Department of Civil and Environmental Engineering of the University of Perugia, as part of the "Construction" project sustainable innovative rural with energy autonomy: hydraulic-architectural-energetic tower Rural Development (TIAR) "heterogeneous with random structure: application to masonry with non-periodic weaving," at the Department of Civil and Environmental Engineering of the University of Perugia.

Mahmoud Yousef M. Ghoneem is an Associate Professor in the Architecture Department, Faculty of Fine Arts, Helwan University in Egypt. Since he obtained his Ph.D. in architecture in 2011, which concluded to create a methodology for achieving the environmental equilibrium inside cities, he received numerous diplomas in Environmental Engineering (AUC, 2011) and Urban Management for climate change (IHS, Erasmus University Rotterdam, 2014) and he participated in many international conferences and workshops.

Chaham Alalouch is an architect, researcher, and educator with a background in urbanism. He is concerned about how to improve people's quality of life through sustainable built environment. He believes that the built environment (building and cities) is made for people, and it should be designed and constructed as such. Dr. Chaham's research was recognized for excellence. His Ph.D. was awarded the MacFarlane Prize by Heriot-Watt University in the UK, and one of his peer-reviewed journal papers was awarded the Highly Commended Award at the Emerald Literati Network Awards for Excellence, UK. He has authored and co-authored more than 20 articles, technical reports, and a book covering a wide range of topics related to this broad area of interest such as healthcare building design, privacy, spatial experience of space users, space syntax, restorative environments, stakeholder's involvement in the design process, and passive and sustainable design and construction. He is also a member of Oman eco-house project and currently undertaking research in architectural pedagogy and "livability" of eco-architecture. Dr. Chaham held invited talks and keynote speeches at several international conferences. He also acts as a reviewer for a range of reputable journals, and as a scientific committee member responsible for a number of international design schools, demonstrating academic leadership. He is currently teaching and researching at Sultan Qaboos University in Oman, having previously researched and taught at universities in the UK and Syria. There, he also worked in several architectural consultancy firms and in two European Commission-funded projects, namely STRABON (Multilingual and Multimedia Information System for Euro-Mediterranean Cultural Heritage and Tourism) and HERCOMANES (Heritage Conservation and Management in Egypt and Syria). Dr. Alalouch is the Series Editor responsible for book proposals submitted in the field of Sustainable Architecture and Urbanism, and Architectural Heritage.

Dr. Nabil Mohareb is an Associate Professor with over 18 years of academic experience. He has worked for a number of distinguished universities in three different countries, with the most recent one being Beirut Arab University, Lebanon. With more than 8 years as the head of faculty branch, Dr. Mohareb has a number of published papers where his research focuses on the relationship between architecture and urbanism. He is also interested in social behavioral activities, the reciprocal effect of both spatial and economic variables in urban spaces, and their interrelationship with architectural design.

Part I

New Approaches and Concepts in Conservation of Cultural Heritage in Historic Cities

The first part of this book provides a very detailed and in-depth review of various technical strategies that could be employed to conserve heritage sites. The authors of the following chapters are heavily focused on countries known for their rich heritage, culture, and history such as Egypt and Jordan. The following research papers do not only highlight a given problem, but they provide practical, tested solutions that could be applied right away.

In chapter one, "The Effect of the Archeological and Architectural Nature of the Cities on the Form and Design of Public Transportation Vehicles," the author focuses on Islamic, Coptic, and Jewish archeological sites in Egypt and the "vibrations" that ultimately destroy them. These "vibrations" are usually a result of poor traffic systems that destroy heritage sites. The aim of this chapter is to determine some of the requirements needed when designing transport systems in archeological areas. The author's proposed solution is to only permit the movement of lightweight, slow-motion vehicles with a speed range of 25 to 50 km/h in those areas. The author also stresses the importance of applying isolation layers in the engine chambers of vehicles, and he also encourages governments to advocate for electrically operated engines.

The author of chapters "The Future of the 'Insurance Plan' in Cairo and Alexandria" and "On the Spatial Conservation of Roundabout Cairo Using Pitteway Graph" is inspired by historical European insurance and conservation plans and examines the possibility of adopting historical European policies in Egypt. In the second chapter titled "The Future of the 'Insurance Plan' in Cairo and Alexandria," the author analyzed the 1905 interdisciplinary insurance plan for the European colony in Cairo. It addresses the key issues of urban structure, function, and insurance. According to the author, the unique network of open spaces integrated the ancient sites of the two cities into a new layer of European town planning. The core "Ezbekieh Plaza" in Cairo projected the chain of radial roundabouts wherever a landmark is found. Alexandria, however, revived the two ancient harbors along "Rue Ibrahim" from the docks up to "Place des Consuls" of socioeconomic node. The cultural change, however, of national Egypt since 1952 lost the international character of the historical European Quarters due to the low-income "rent control" constraint and the unrecognized building insurance policies, in addition to the lack of building enforcement to create a different urban form. In chapter three, "On the Spatial Conservation of Roundabout Cairo Using Pitteway Graph," the author closely examines roundabouts that are positioned in areas with heritage landmarks.

Chapter four, on the other hand, examines materials used to construct heritage sites themselves rather than external factors that impact them. In Chapter "Laboratory Evaluation of Nanoparticles for Consolidation of Limestone in Archaeological Site of Jerash," the authors focus on limestone used in the construction of archeological heritage structures in Jordan that are currently deteriorating due to exposure to atmospheric conditions. They found that the solution to lengthen the life of limestone could be synthesizing nano-sized particles of calcium hydroxide dispersed in an alcoholic medium which significantly improves its mechanical properties.

Chapters "Adapting Geographies of Gentrification in Egypt: Lesson Learned from Fatimid Cairo and Heliopolis" and "Applying the Gentrification Indicators in Heliopolis District" examine the concept of "gentrification." The authors re-define gentrification and in "Applying the Gentrification Indicators in Heliopolis District," they use a district in Cairo as their case study.

In "Technology and Architectural Heritage: Dynamic Connections," the author outlines the dynamic connections

between technology, the whole idea of architectural heritage, and ways to intervene. A focus is placed on four main theoretical aspects, the effects of which are also significant on the practical field: the distance from contemporaneity, the concept of time, reliable conservation, and sustainability.In the final chapter in this part, "Historic Urban Regeneration Concepts; A Rethought for Indian Context," the author provides a very cultured yet informative end to this part. The author aims to answer the questions: Why should we conserve architectural heritage and for whom? Offering the points of view of both professionals and citizens, this chapter acts as a very fitting ending to an enlightening part of this book.

The Effect of the Archeological and Architectural Nature of the Cities on the Form and Design of Public Transportation Vehicles

Mohamed Moheyeldin Mahmoud Mohamed

Abstract

Multiple Islamic, Coptic, and even Jewish archeological sites are located in many Egyptian neighborhoods such as Alsayeda zainab, Aldarb Alahmar, and Algammaleya, in which they are exposed to a daily and continuous high rates of traffic intensity causing vibrations. Vibrations could be stated as one of the most important challenges that face the archeological buildings and threaten their survival. The impact of vibrations varies due to the nature of the soil, the nature and building conditions, how far the source of vibration is, and the period of exposure. Traffic vibrations could also be stated as one of the most common types of vibrations having the greatest impact on buildings and archeological installations. These vibrations result from the way that the vehicles behave with different types of roads varying in shape, nature, and type of obstacles. Other elements concerning the vehicle itself such as speed, weight, and load have a direct impact on the vibrations resulting from the vehicle movement that could not be neglected. The research aims to highlight some of the requirements that should be taken into consideration when designing public transportation means operating in various archeological areas, in order to preserve the archeological nature of the place. Light-weight slow-motion vehicles should be used (25–50 km/h at maximum) having a multi-leaf steel spring suspension system instead of having an air bag one in order to reduce generated vibrations that could destroy the archeological buildings may be stated as one of the most important research outcomes. Using isolation layers in the engine chamber could also reduce the resulting noise-causing vibrations. Electrically operated engines that use solar photovoltaic cells as a source of electricity could be also used in substitution with gas ones in order to reduce the resulting engine noise.

Keywords

Archeological • Design • Vibrations • Suspension • Isolation layers

1 Introduction

The way of depicting various political, economical, cultural, religious, and artistic aspects of the cultural scene could be described as Archeology.

However, the term Archeology could be stated as one of the most important factors that define the cultural identity and cultural component of different societies.

Distinguished by a number of monuments and architectural styles that date back to each country showing how genius the elders that had lived on that land long ago were, leaving their legacy and great achievements in the form of monuments and buildings, utensils and pots, tools and papers representing the real value of each country and how it differs from the others.

Egypt was discriminated to witness many civilizations and as a haven and passageway for all heavenly and even non-heavenly religions.

The Islamic civilization is known as one of the richest eras that Egypt had witnessed after the ancient Egyptian civilization. Mosques, houses, water taps, and shrines could be easily found in almost all the Egyptian cities and neighborhoods.

At the heart of Cairo lie many Islamic monuments and landmarks dated to various Islamic periods that could hardly be described by experts due to their architectural beauty.

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2 Goal of the Research

The research aims to determine some of the requirements that should be taken into consideration when designing public transportation means operating in the archeological areas, in order to preserve the archeological nature of the place.

3 Hypothesis

If it is possible to develop a better designed public means of transport operating in various archeological areas, then a practical way of survival could be easily obtained.

4 Research Methodology

Descriptive analytical method is used relying on the compiling, comparing, and analyzing of information and facts in order to get acceptable perceptions, ideas, and considerations.

5 Research Limits

The heart of Cairo, specially the neighborhood of Alsayeda Zainab, Ibn Tulun square.

What is meant by vibrations:

Vibrations could be stated as one of the most dangerous threats facing this wealthy culture.

A body movement or oscillation under the effect of a natural force or disaster, such as earthquakes, landslides, and storms, could be defined as vibrations (Hunaidi 2000).

Daily activities such as using elevators, construction activities, and the enormous growth in using aircraft, trains, buses, etc., could be also a source of vibrations.

Vibrations transfer to the nearest object or building through a median as the layers of the soil in the form of waves (Hunaidi 2000).

Measuring the displacement from peak to peak is often used in order to indicate the strength of vibrations (Update International n.d.) (Fig. 1).

Depending on not only the nature and strength of the source of vibration, but also the geological nature and components of the soil, the nature of the construction materials and the limits of underground water play an important role on how vibrations affect the archeological building (Science direct.; Ellis 1987).

Vibrations last for a very limited period of time which does not exceed 0.05 s (Bata 1971), and with amplitudes that vary from 0.01 to 0.2 mm/s on smooth road surfaces, while it can reach from 0.1 to 2.0 mm/s over irregular road surfaces (Eltawkeel Journal n.d.).

Vibrations under 0.5 mm/s would be barely noticeable while rattling of windows, loss of objects, and crockery could happen when exceeding that limit (Eltawkeel Journal n.d.).

In a comparison between the amount of generated vibrations from the motion of a bus and a truck having the same weight, we can get that:

Location	25 km/h		50 km/h	
	Bus	Truck	Bus	Truck
The ground facing the house	20.5	19.9	64.5	33.2
The external foundation wall	11.2	10.1	30.9	15.7
At the first floor	20.3	20.8	62.9	30.1
At the second floor	35	37.3	96.2	46.7

As given in the above table, the speed of the vehicle is directly proportional to the generated vibrations.

At the speed of 25 km/h, the generated vibrations from the motion of the bus are equal to those generated from the motion of the truck, while the table shows that when raising the speed to 50 km/h, the generated vibrations from the motion of the bus are double the ones generated from the truck, that is because a multi-leaf spring suspension system is used in the truck, while an air-bag suspension system is used in the bus (Hunaidi 2000).

Regarding the British Standard BS 5228-2-2009 that recommends controlling of noise and vibration eliminations, a number of studies took place in many different places such as Beijing and New Delhi, in order to study the effect of vibrations on historical buildings (Basekar et al. 2015; Morbia et al. 2013).

In such a way, the idea of determining some factors or regulations that should be taken into consideration when designing public transportation means specially operating in the archeological and historical places such as the mosque of Ibn Tulun, and its surrounding area took place.

Description of the mosque:

At the heart of Cairo and inspired by the Samaritan architectural style lies a unique style of mosques.

Occupying what exceeds 26,000 m^2 of the top of what was known by the elders as “Jabal Yashkur” and by the year 876 AD, Ahmed Ibn Tulun began constructing his great mosque.

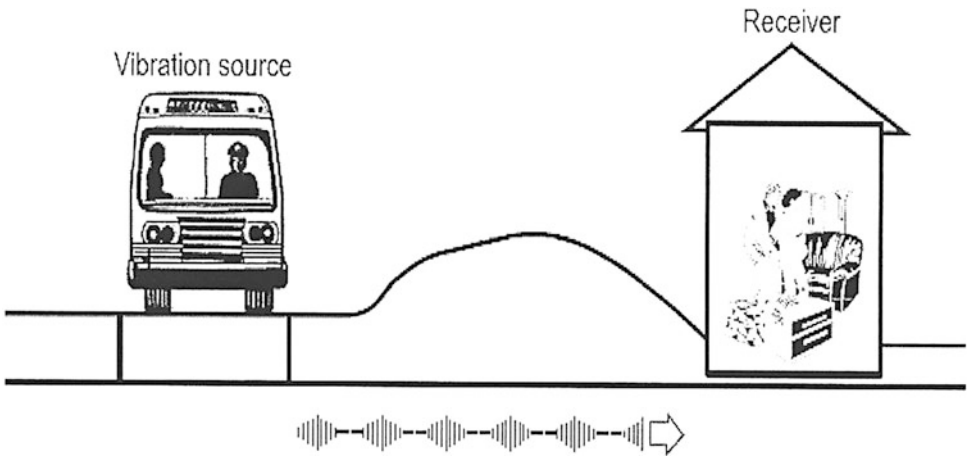

Fig. 1 Transmitting of vibration waves (Basekar et al. 2015)

Being 138 m long and 118 m wide, with a unique spiral shaped nearly 40-m long minaret, having 42 entries, 129 of geometrically motifs decorated gypsum windows, without using any columns and using bovine system instead, Ibn Tulun Mosque came true (Salah Eldin 2001) (Figs. 2 and 3).

A two-floored ancient house, used as a museum, containing many glass, plaster, and porcelain pieces dated to different decades is adjacent to the mosque and lies inside its outer fence.

The current situation of the mosque:

The mosque was exposed to a number of renovations throughout the different eras, some of which were not so successful, but others helped to preserve the mosque in its present condition.

Weakness and decay could be easily noticed not only on the walls and fences of the mosque, but also on the lime stone soil where the mosque itself was built under the effect of the high limits of salty underground water that saturates the walls (Fig. 4).

Fig. 2 Mosque of Ibn Tulun

Fig. 3 Minaret of the mosque

Some cracks could also be noticed on the walls and bovines holding the mosque (Fig. 5).

Surrounded by some narrow double-way streets not exceeding 15 m at its widest, with high traffic rates of all means of transport, and with its current situation, the mosque could hardly survive (Fig. 6).

Fig. 4 Decay on the walls and fences of the mosque

Fig. 5 Some decay and cracks on the walls and bovines of the mosque

Specifications of monitored means of transport Working in the area of the mosque:

Private cars, taxis, microbuses, and even minibuses, different forms and sizes of means of transport, working in the area of the mosque, generating vibrations could hardly be noticed. The problem, the whole problem concerns with a bulk weighing 18 tons that could be defined as buses (Masress Journal n.d.; Aldabae 2010).

Having a six-cylinder 270–290 Hp diesel engine, one-piece chassis, and an automatic gearbox, hundreds of buses work through the area of Ibn Tulun Mosque in a continuous daily motion generating an obviously unacceptable limit of vibrations that could be described as a catastrophe threatening the mosque (Elyomnew Journal n.d.; Kawayed 2015).

Referring to the previously mentioned table, some calculations were made as follows:

In order to achieve the best performance of the public transport buses with the most suitable generated vibrations:
At the speed of 50 km/h
The frequency shouldn't exceed 1500 Hz; velocity shouldn't exceed 0.5 mm/s
While the acceleration should be approx. 50 m/s^2 and the displacement should be 0.11 .

Fig. 6 Streets that the mosque is surrounded by

6 Conclusion

1. A way of coordination between modern life (modern means of transport and other means of satisfactory) needs and the ones required for the historical and archeological protection should be taken into consideration.
2. Light-weight slow-motion vehicles should be used (25–50 km/h at maximum) having a multi-leaf steel spring suspension system instead of having an air bag one should be used in order to reduce generated vibrations that could destroy the archeological buildings.
3. Developed tires that have the ability to decrease the rolling resistance should be used, though the road depreciation rate will be decreased as well as the vibration limits.
4. Using isolation layers in the engine chamber could reduce the resulting noise-causing vibrations.
5. Electrically operated engines could be used in substitution with gas ones in order to reduce the resulting engine noise.

7 Recommendations

- Streets should be annually monitored, well paved with a hard, stiff damping material in order to decrease the traffic vibration levels.
- Soft clay soil roads should be cured, improved, and replaced with a harder one in order not to amplify vibrations.
- Leveling of manhole covers, potholes paving, and using underground vibration barriers whenever possible could be an effective solution in decreasing of vibration levels.

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The Future of the 'Insurance Plan' in Cairo and Alexandria

Ali Essam El Shazly

Abstract

The expired Insurance Plan of Cairo and Alexandria had affected their European progress due to the national shift of sharp decline at present. The plan surpassed an ordinary urban survey to include socioeconomic and administrative criteria, which are clarified for future conservation in objective. The study compares the current local situation to the original international status in 1905 according to the insurance document along with the supplementary municipal byelaws. The essence of administrative demarcation filtered the colonial zones from the native areas in various dimensions. The intermediary zone not only structured smooth transition of a hybrid type of commercial building evolution, but also sustained the colony through the insured building stock. Further municipal taxes were invested in infrastructures with concise landuse and urban form to suit the European lifestyle apart from the exempted preexisting irregular pattern. The current authority, however, turned all strengths into weaknesses of fragmented territories. The unknown policy of insurance planning to natives with the cultural change had facilitated the historical colony to the dissolution. The generalized building code and the low-income policies constrain the upkeep of colonial heritage with different redevelopment. Meanwhile, the recent attempts of freed real-estate market and the incentives of foreign investment had no impact on the European zones to keep deteriorating with all types of environmental pollution. In brief, the private Insurance Plan coincided with the municipal policies to deduce the integrated governance of the colony in contrast to the current practice. Thus, the prospected autonomy potentially impacts this colonial heritage following the footprint of the historical Insurance Plan, if to be conserved.

Keywords

Cairo • Alexandria • European colony • 1905 Insurance Plan • Urban decline, Conservation

1 Introduction

The early modern history of Egypt highlights the two urban centers of Cairo and Alexandria for international transformation. Both cities of comparable European development since Napoléon in 1798 had attracted the largest foreign population in the country with an extended urban structure of cosmopolitan character (Mubarak 1889). The later milestone in 1905 of two individual portfolios of 'Insurance Plans' for central Cairo and Alexandria had demonstrated the advanced European town planning of Egypt and the socioeconomic structure as well. The detailed historical plans of insurance developed worldwide through private enterprises in the West, which extended from being ordinary survey maps to become a documentary system of updating the urban infrastructures with the building characteristics such as function, height, structural elements, and ownership (Warner 2001). The main purpose of this cartography was for fire risk to be handled by the insurance business companies. In Egypt, however, the Insurance Plans encapsulated further colonial interpretation against the political instabilities. The respective British Municipality in Cairo and Alexandria adopted the Insurance Plan as part of their developmental policies, thus sustaining the European Quarters of continual development in the two cities while expanding the businesses of the European insurance companies.

The sudden mass exodus, however, of Europeans in 1952 from Egypt due to the revolution for independence and nationalization policies had terminated the foreign municipal affairs. And as a result, the expired 'Insurance Plans' of the Egyptian colony have been kept silent in history. The nationalized real-estate market had enforced a permanent

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low-income rent control policy, which over time could not afford maintaining the European urban heritage of run-down condition at present. The scope of a few previous studies had described the historical Egyptian Insurance Plans, which detailed the status quo of development without exploring the socioeconomic dimensions of colonial conservation however (Warner 2001). Objectively, this study attempts to rediscover the intriguing scenario of the historical European 'Insurance Plans' of Cairo and Alexandria in contrast to their current national situation. The comparison explores the socioeconomic relationship to the built environment of current decline. In this regard, the specific issue of territorial demarcation details the relationship to the urban structure with the landuse and insurance systems as the major indicators of determining the strengths and weaknesses of the 'Insurance Plan' before and after the nationalized policies. The study concludes the key changes from the historical 'Insurance Plan' at different levels of resolution with the opportunities and threats of future prospects for conservation.

2 The Insurance Plan of Cairo in 1905

The tariff demarcation in 1905 of the Insurance Plan clearly follows the spatial structure, where the A-zone of the colony is separated from the C-zone of old Cairo through the intermediary B-zone of 'Abdin' into which the major open spaces are invested (Fig. 1). The landuse planned the new colony at hierarchal resolutions from the general zoning down to the detailed sites in overlap with the different endogenous town in the C-zone (Figs. 2 and 3). The layout separated the European activities in the edged empty land between old Cairo and the Nile. The interface of the B-zone between the two towns was resolved through several plazas of different urban structures from the roundabout network. The two successive plazas of residential 'Bab El Louk' and 'Abdin' palace separated the colony from the adjacent old Cairo. Nevertheless, the spacious 'Ezbekieh' garden and the surrounding plazas of 'Le Bourse, L'Opera, Ataba and Jardin Rosetti' extended the separation. From 'Ataba' in the B-zone, the new commercial spine of 'Rue Neuve' intersected with the old spine of Cairo to become accessible. The other arcaded 'Rue Sultan Hasan' bisected old Cairo up to the Citadel with new royal establishments. The third 'Rue Abdelaziz' transformed the irregular surrounds into a retailing bypass to 'Abdin' plaza. The other plaza of 'Le Bourse' projected 'Rue Claude Bey' of commercial arcades that crossed the maze network to end up in the new Cairo Station. Therefore, the strategy of insurance accessed the C-zone old Cairo through commercial spines in conjunction with the B-zone of major open spaces.

At the detailed resolution, the outer plazas of the B-zone filtered the inner 'Ezbekieh Garden' in the adjacent A-zone to form the major socioeconomic hub of the colony. The garden clustered European consulates, missionary establishments, schools of various communities, grand hotels, cafés, theaters, royal L'Opera, furnishing houses, commercial banks, mixed tribunal, municipal buildings such as the fire brigade, postal office, business offices, retailing shops, and stables. The plaza set a new eclectic 'Okelle' building type featuring the Italian 'Galleria' and the endogenous 'Wekala' tradition, thus the name derived. This four-story masonry building functioned for shops, dwellings, and offices, with characteristic neo-renaissance façades from the exterior and interior galleries as well. This building function spread from 'Ezbekieh' to the surrounding plazas and the planned spines in old Cairo as well. In this regard, the buffer zone of commercial activities facilitated the backyard of 'Ezbekieh' garden to accommodate the new European lifestyle and public facilities of modern Cairo in detailed demarcation of zoned landuse by insurance.

From the core area of 'Ezbekieh' spread the A-zone of roundabout structure. The boulevard network first developed into gardened chateaux housing with the 'Hippodrome' facility for the European community. Over time new apartment buildings of ground floor shops replaced the early chateaux type and characterized by neo-Gothic and Victorian façade ornaments. More commercial and cultural functions gained potential in this zone such as department stores and cinema houses to become the modern downtown of Cairo. Nevertheless, the waterfront developed into a royal quarter of palaces, hospital, school, press and publishing houses, workshops, in addition to the housing of the elite European community on the Garden City concept. The Nile edge transformed into a gardened promenade with the new bridge crossing toward the Giza suburbs up to the pyramids plateau. The European infrastructures of gas, water, and tramline networks developed the colony on the city level. The extended landuse developed residential suburbs in all directions to integrate with the countryside. And as a result, the unconstrained A-zone of the Insurance Plan afforded the landuse transformation in relationship to the city extensions of the colony in contrast to the constraint old Cairo traditions through the hierarchal B- and C-buffer zones of commercial landuse interception.

The Insurance Plan correlated with the rapid increase over an exact decade of Cairo's European population from 35,385 up to 55,987 in 1905 to cause the European colony's building boom (Owen 1969). The French pioneer, Haussmann, had first planned the quarter in 1867 on his Parisian precedent of roundabout spaces in radial boulevard network, which later spanned the A-zone of the Insurance Plan from the irregular medieval town of Cairo toward the Nile front. The core

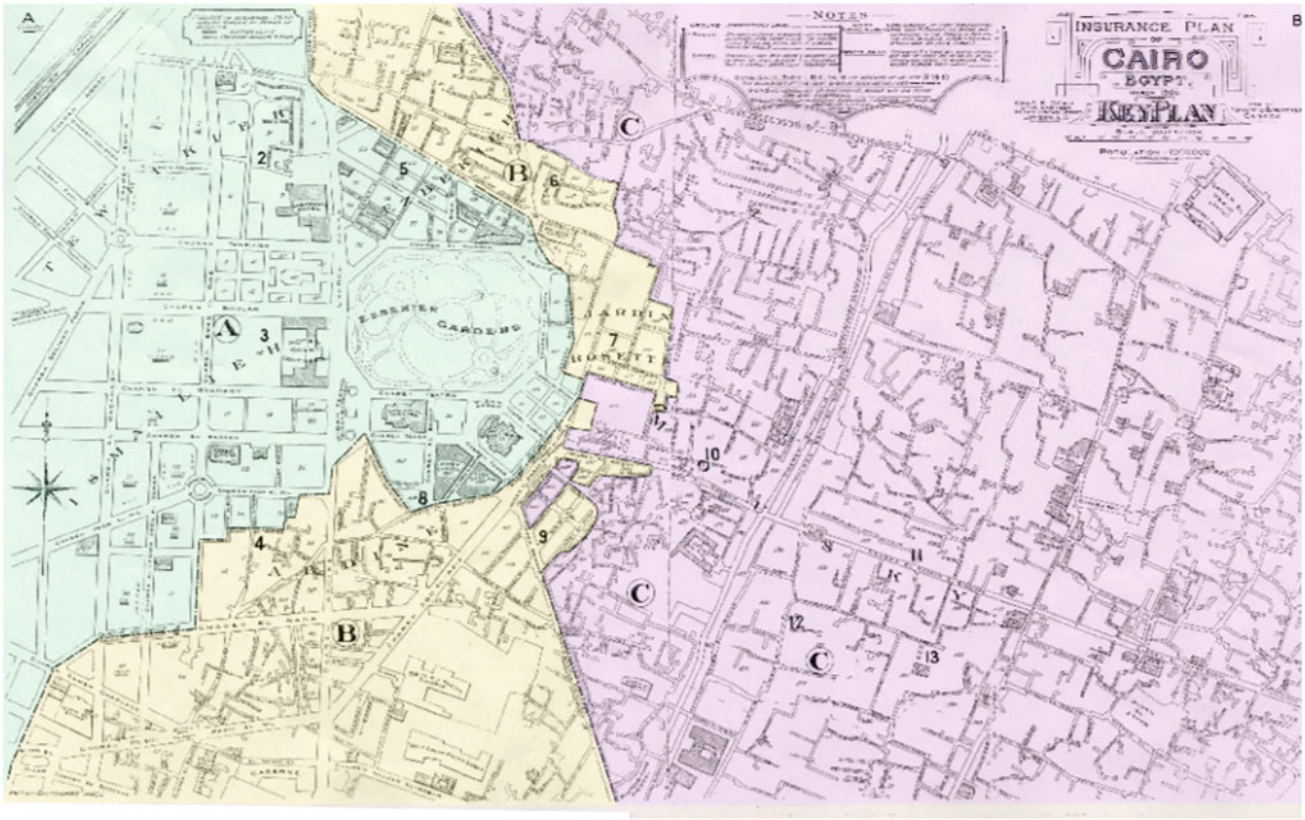

Fig. 1 Administrative demarcation of Cairo's 'Insurance Plan' in 1905. Prepared by the author, based on: Goad C E, Insurance Plan—Cairo. London/Montreal: Goad CE Press; 1905

garden plaza of 'Ezbekieh' where the Insurance Plan in 1905 focused on was originally a natural lake. The plaza was landscaped in 1870 by the French, De Schamps, and clustered the surrounding subplazas in a maximum choice of pedestrian networks. From this plaza, several boulevards were superimposed on the informal urban tissue of the existing town and the empty land toward the Nile edge to become the major connector on the city level and link the new European Quarter with the major monuments of all times found in Cairo (El Shazly 2003a).

The townscape regulated the widths of 3 m for the cul-de-sacs up to 50 m length and 4 m for longer, 6 m for any street joining another with a minimum 1 m chamfer of right-angle intersects, 10 m for the main streets, and minimum 12 m for the major boulevards with 4 m added to the line of trees on both sides (El Kalzah 1907, p. 221). Whereas the building line was set parallel to the central axis of the street, the historical buildings and areas of special character were exempted and regulated to preserve the original situation including redevelopment unless otherwise a decree of the Director of Public Works Department specifies differently in a case-by-case manner of development (El Kalzah 1907, p. 222). The massive buildings of four-story height surrounded the central 'Ezbekieh' garden and plazas with further extension along the projecting throughways, while the radial boulevards were permitted up to six-story building height with planned façades. The façade line on the street was not allowed to project balconies more than 1 m at minimum 4.5 m height, and maximum 20 cm decorative projections for the ground shops of uniform commercial signs (El Kalzah 1907, p. 226). The municipal byelaws differentiated the building regulations of the new colony from old Cairo. This enforced the uniform building development in each zone of the colony. Meanwhile, the exempted irregular pattern excluded by default old Cairo from the new European-style building and open space regulations. Therefore, the byelaws of the built-up environment correlated indirectly with the zoned-up Insurance Plan of exclusive European development apart from old Cairo in the C-zone of further facilitation to the traditional dissolution in a case-by-case manner of retreat.

The municipal policies enforced the Insurance Plan through byelaws of various dimensions. The byelaws ranged from the absolute extents of planning act such as taxation

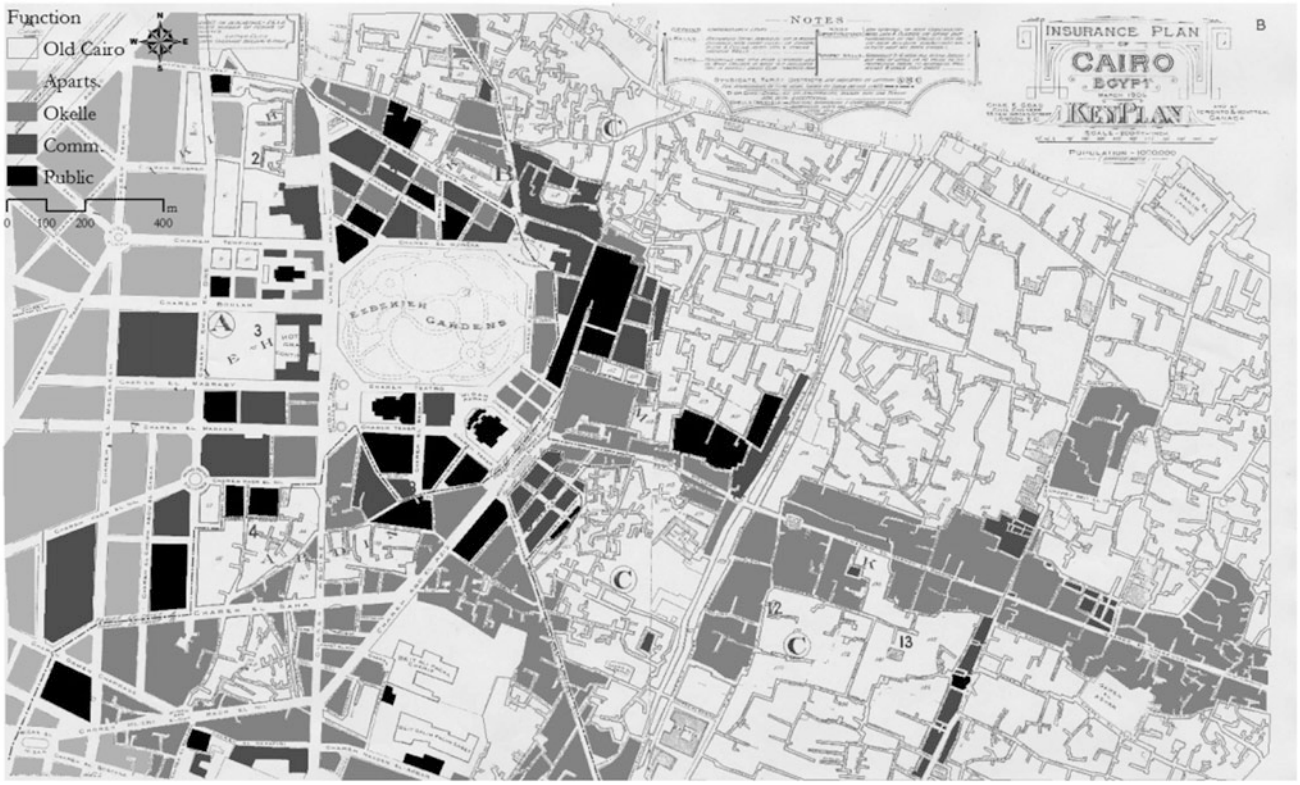

Fig. 2 Building function of Cairo's 'Insurance Plan' in 1905. Prepared by the author, based on: Goad (1905)

down to the most specific resolution of executive regulations in building works. The municipal byelaws compiled the domains of municipal formation and administration, revenues, engineering and others, hygienic and veterinary, public facilities, and health decrees. The real-estate taxation enforced the byelaw as: '12% of the rental value on any private asset' (El Kalzah 1907, p. 136), in addition to the increased municipal income from the byelaw of; 'A half of the net profit up to the limit of L.E.8000 for each consecutive five-years from the date of any sold public realities' (El Kalzah 1907, p.171). More municipal revenues collected: '½ in thousand on exports and imports' (El Kalzah 1907, p. 168), in addition to other miscellaneous taxation such as the quarries in public territories, slaughterhouses, and carriages. The taxation byelaws were enforced on all nationals and on all zones of Cairo, which revised the exemption of early foreign settlers from all types of taxation. The maximized revenues from the free commercial and real-estate markets were necessary to sustain the expansion of the city zones with more investment in public works on the city level.

The insurance market was introduced to Egypt during the early nineteenth century according to the policy of free market. French early Insurance Plans covered the areas of major interests such as the flourishing businesses of the port district in Alexandria. The British taking over in 1882 continued the practice of insurance with the comprehensive 'Insurance Plan' published in 1905 for the European downtowns of Cairo and Alexandria. The common practice of the Insurance Plans in 1905 specified: (1) colors (finishing materials of brick, stone, or concrete), (2) walls (party wall, entire wall, defective wall, and others), (3) openings (including gates and passages), (4) windows (unprotected, protected by wired glass, or protected by shutters), (5) floors (number of stories, basements, and attics), (6) skylights (glazed with or without holes), (7) hoists and lifts (enclosed or open to street), (8) roofs (material and profiles), and (9) sundries (steam boilers, steam engines, auto fire alarm, water hydrants, chimneys, stand pipes, and others) (Goad 1905). The process of insurance enabled the private investment of Charles Goad to produce the Egyptian Insurance Plans of 1905 and commissioned F. Marschner Esq. in Cairo and L. Schuler Esq. in Alexandria for distribution to subscribers of private insurance companies or public institutes. Each subscriber obtained a copy of the contracted Insurance Plan with regular updates on map information. The subscriber uses the Insurance Plan for detailed assessment of actuarial contracting with the individual owner client (Warner 2001). Thus, the system of Insurance Plan sets all involved parties in profiting stance, with the underlying objective of sustainable urban conservation. Here also the incentive of building insurance was minimal for the old zone of Cairo, whereas the new colonial developments

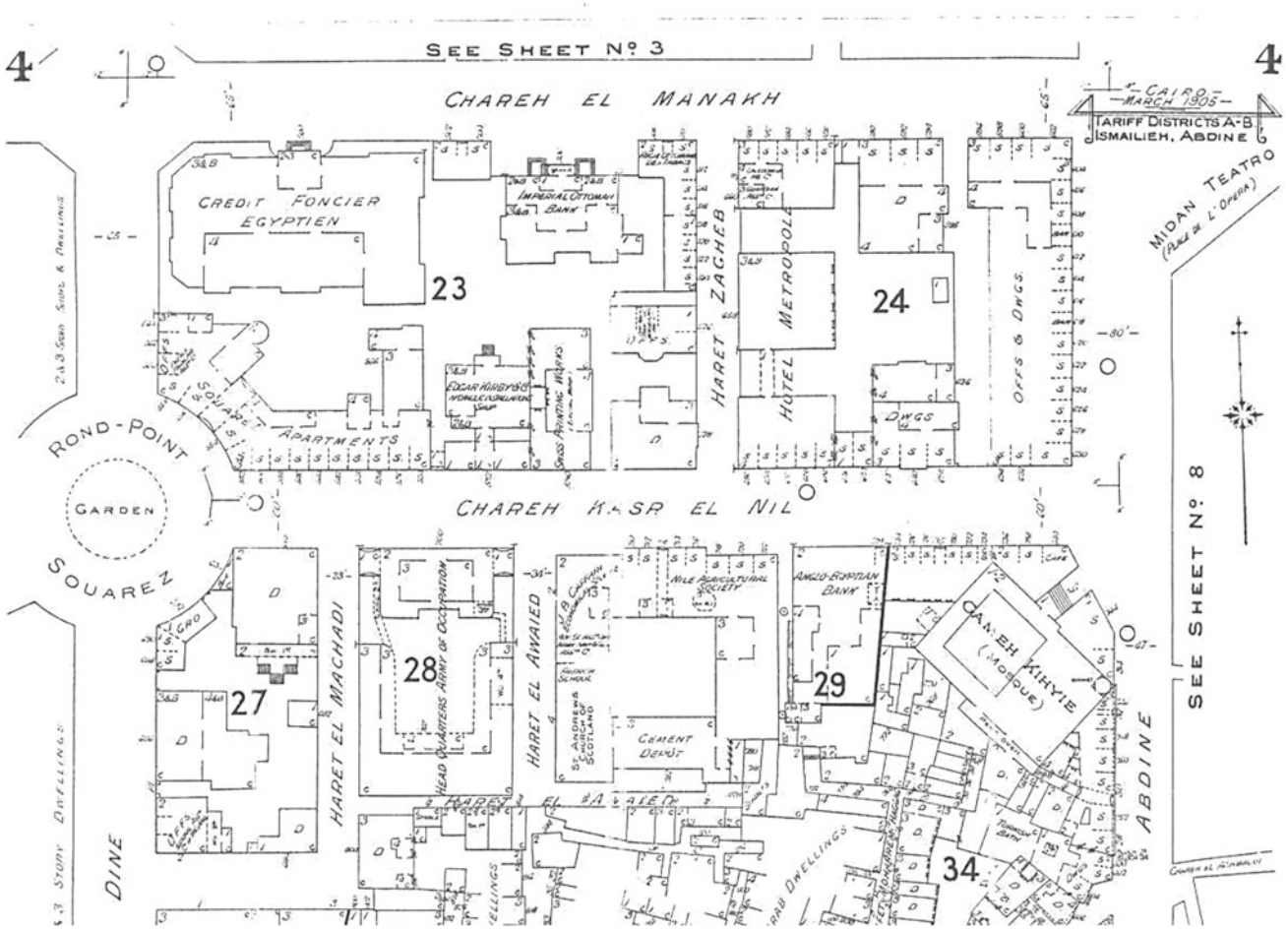

Fig. 3 Sample sheet of Cairo's 'Insurance Plan' in 1905. Sheet No. 4 in: Goad Goad (1905)

attracted the backing up by insurance as indicated by the Insurance Plan itself.

3 The Insurance Plan of Cairo at Present

The landuse of the Insurance Plan at present Cairo totally differs from the original situation. The original demarcation into three zones has been dramatically changed without any criteria of development (Fig. 4). The dissolved B-zone of landuse filtration process by insurance had affected all other indicators of urban structure and socioeconomic policies to affect the attempted conservation at present. The law of urban design designates the downtown district for the functions of *'commercial, residential, recreational and cultural facilities'* (The MHR 1995, p. 16). In the present demarcation, however, the downtown district is shifted to old Cairo without any functional role of the split historical

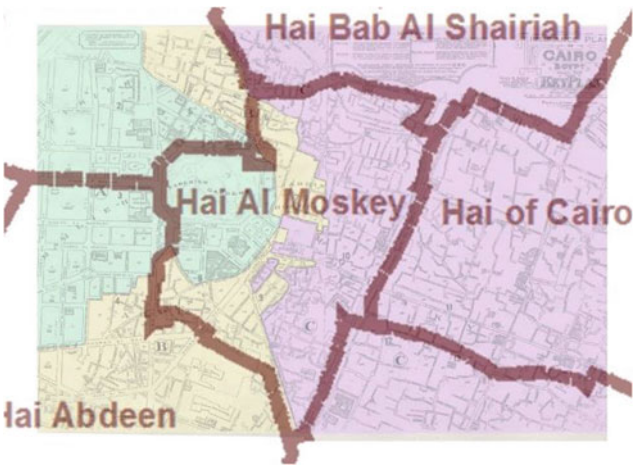

Fig. 4 Shattered demarcation of Cairo's colony at present. Prepared by the author, based on: The Central Agency of Public Mobilization and Statistics (CAPMAS) of Egypt, The GIS Department, 2006; and Goad (1905)

colony into two districts of 'Hai Western Cairo and Hai Abdeen' of no relationship to the original delineation by the Insurance Plan. Also the current two-district demarcation of the historical colony extends beyond the distinctive character of the area without any specific correlation to the historical urban structure of roundabouts, plazas, and gardens. This has affected the demarcation of the historical colony as one homogenous area for conservation.

The dissolved territories had facilitated the change of land and building functions without any strategy of development. The historical colony at present accommodates a mixture of building functions such as private medical clinics, workshops, governmental offices, and others in a laissez-faire manner. The characteristic roundabouts with the radial boulevards of Cairo transformed into a mere vehicular street at the expense of human amenities. The vehicular priority had eroded the core 'Ezbekieh' gardens and the Nile promenade of negative environmental impacts. Also the buffering open spaces between old endogenous and colonial Cairo have lost their filtration role at the expense of vehicular trafficking. The vehicular bridge along the historical spine of 'Rue Neuve' into old Cairo had destroyed the cognitive structure with the neglect of characteristic 'Okelles' on both sides. The Pyramids Boulevard is no exception from the vehicular pressure to affect the modern access of the world monument. The removal of pleasant tramlines from all routes together with the vehicular overwhelm not only facilitated the dissolution of Cairo's European urban heritage, but also affected the original concept of projecting spines to link the outstanding monuments found in the city (Figs. 5 and 6).

The cultural change following the revolution in 1952 had largely affected the European Quarter. The various conservation acts enforced in Europe against the changing urban form of historical sites, especially during the second half of the twentieth century, no longer applied in Egypt. The present law of urban renewal specifies: '*A) Total redevelopment for areas that suffer from over-population and the majority of deteriorated buildings. B) Partial redevelopment for areas that have some deteriorated buildings and a lack of basic infrastructures*' (The MHR 1995, p. 19). The criteria of execution, however, do not specify the exempted areas of special characteristics or the funding policies of renewal, while the process itself is not clearly defined such as the places of relocating the overpopulated areas. The lack of building enforcement and the absence of sustainable socioeconomic strategies have forced the European Quarter to the deterioration and the rapid redevelopment into conventional high-rise type in contrast to the historical context. Nevertheless, the building redevelopment along the historical boulevards has regulated setbacks for street widening with different building heights and façade characteristics, which has destroyed the historical uniformity of the depth/height ratios and the original building styles in each zone of the historical colony.

Fig. 5 Ezbekieh Garden at present. Photograph at present taken by the author

Fig. 6 Ezbekieh Garden in the past. Photograph in: Arafa A, Cairo during the Reign of Ismail. Cairo: The Egyptian-Lebanese Publishing House; 1998

The European property ownership was distributed between governmental and private ownership. The National Government changed the real-estate policy from the unconstrained market to the generalized 'Rent Control' without distinction by the type of building or the level of income. In this policy, the owner has no right to increase or terminate the rental contract with the tenant, while the latter has the family's right to inherit the rented space in continuation to the same original contract. This policy continues to the present where the law states: '*The monthly rents in Egyptian Pound for building spaces are fixed according to their year built as follows: A) 0.035/m2 before 1890, B) 0.06/m2 from 1890 to 1952, C) 0.18/m2 from 1953 to 1977, and D) 0.5/m2 from 1987 thereafter*' (The ARE 1994, p. 58). Obviously, the amount of collected rents could never cover the property maintenance from the owner's side, while

the renter has no obligation of running cost by law. Over time the problem of managing properties mounted with pertaining disputes between owners and tenants.

Since 1980, the Government has been attempting to liberate the real-estate market in several dimensions. First, the law allowed the ownership of just a unit within a building. Hence, the building owner will benefit from a lump-sum of reasonable amount in agreement with the tenant who can reinvest the unit according to the market forces. Second, the new property ownership had no rent control, but subject to the supply and demand forces with suitable revenue to conduct refurbishments. However, the existing properties of running contracts under the old rent control policy were not considered in the freed rents for the newly owned or developed properties. Third, the old properties of rent control are subject to an annual percentage of increase in rent according to the year built. Since the original rent is negligible, and the percentage of increase is tiny, the total amount has remained far below the actual value of the rent. Meanwhile, the rental functions other than residential are specified a time span of inheritance up to the first generation only; afterwards, the property returns back free to the owner. Overview of the current real-estate policies has mostly affected the old buildings of historical values such as those of the European Quarter's deteriorated building stock, though of highest land value being in the heart of Cairo, thus forcing the redevelopment process.

The conception of building insurance for conservation is not recognized in the present local context of the European Quarter or any other area. Meanwhile, the current law of real-estate taxation states: '*luxury buildings are subject to a monthly real-estate tax of 7% of what is equal to the building's rental value*' (The ARE 1994, p. 66). In this regard, the term 'luxury' is not clearly defined, while the land itself has no taxation. Also the term 'rental value' does not specify the process of evaluation whether according to the old rent control or the actual value. Now the Egyptian building law has enforced a unified code of urbanism with its executive regulations being under revision (The MHR 2009). The new code, however, lacks the conservation acts such as the historical European heritage in Cairo and Alexandria. Also the new enforcement of real-estate taxation on lands and buildings has no clear criteria of estimating the property value for tax calculation and left to subjective decision by the local authorities. Meanwhile, liberating the rent control is not foreseen due to the major socioeconomic consequences of the majority low-income occupants of historical buildings at present without clear strategy of future development or relocation. Despite the continual research and institutional efforts of exploring the special merits of the historical European Quarter in Cairo and Alexandria for conservation, they are limited to comprehensive documentation (e.g., Scharabi 1989) and visual enhancements (e.g., The UPD 2002) without a proper strategy of functional or investment policies for conservation.

4 The Insurance Plan of Alexandria in 1905

The Insurance Plan of Alexandria was totally different from the case of Cairo. In Alexandria, the town was deserted with historical relics of the ancient times. The endogenous town was limited to a small Turkish Town on the neck of land between the two deserted ancient harbors. The early European settlers of the modern time had fewer borders with the existing town in contrast to the case of Cairo. The modern European development regenerated the ancient town along the Eastern Harbor, while developing the other Western Harbor for the new docks and port activities. Thus, the case of Alexandria developed two volumes of 'Insurance Plan' for the port district and the downtown European colony in separate. The European foreign population of Alexandria had reached up to 56,406 in 1905 tripled in number from ten years before (Awad 1987, p. 95).

The empty lands afforded the landuse zoning along the two distant harbors with their linkage (Figs. 7, 8 and 9). The new shipping of the Western Harbor concentrated the warehouses with the port services. However, the opposite Eastern Harbor integrated the port businesses with the socioeconomic functions of the new colony. Unlike Cairo, tariff demarcation was not an issue due to the dominant European development of the modern town. Simply the demarcation followed the town wall relics of the ancient time on the Eastern Harbor, while the Western case stretched next to the Turkish Town along the harbor with the dense cluster in the southern empty lands at the railway terminal depot besides the sea meeting of the Nile canal. The Insurance Plan detailed the two poles where the landuses supported each other in one integrated port development. The new docks absorbed the bulk of functions related to shipping such as the administrative customs house and immigration. The private ownership developed warehouses of major shipping lines and workshops. The residential and retailing uses were limited to the port laborers. The new docks and arsenal were built early in 1835 by the French engineer, Le febure de Cerisy, and overlooked by the landmark of 'Ras El-Tin' Palace.

The port business offices, commercial activities, and residential and cultural functions spread along the Eastern Harbour. The new plaza of 'Place des Consuls' concentrated the commercial/residential building type of 'Okelle' similar to Cairo, with the surrounding interior passages opening to the gardened plaza. The plaza concentrated the commercial offices and residential flats with ground shops along the interior galleries and the outer façades as well. The open

Fig. 7 Alexandria's 'Insurance Plan' in 1905 along the two ancient harbors. The Key Plan of Alexandria's Insurance Plan on the two harbors in: Goad (1898)

space of the plaza separated the regenerated colony from the Turkish Town of irregular pattern. This plaza was first designed in 1834 by the Italian engineer, F. Mancini, with the surrounding lands granted to the European communities for modernization policies. The 'Insurance Plan' in 1905 shows the transformation of 'Place Des Consuls' into a 'T-shaped' plaza of French Gardens, which integrated with the new seaside quay. The surrounding 'Okelle' buildings redeveloped into crossing pedestrian galleries, which supposes the shaping analogy of 'Place Des Consuls'

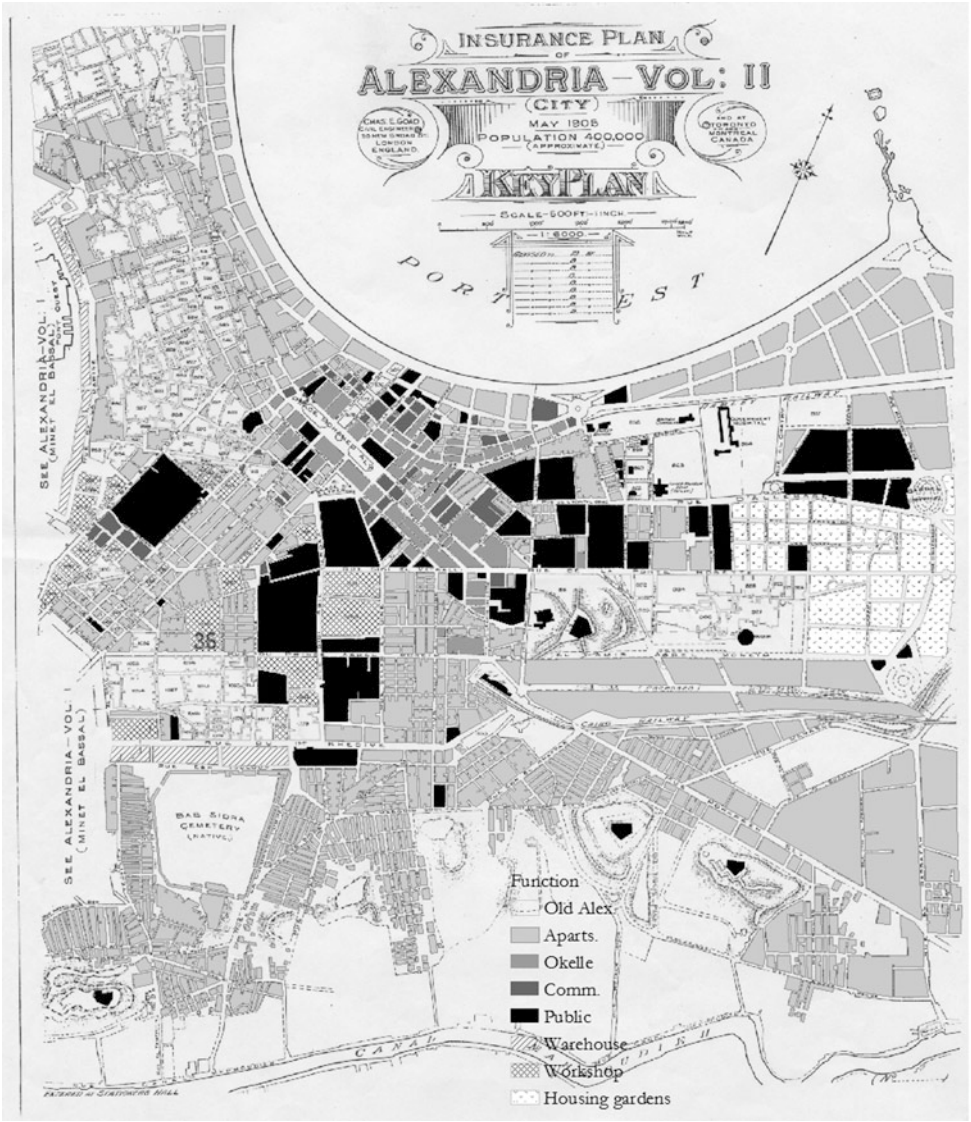

Fig. 8 Building function of Alexandria's 'Insurance Plan' in 1905. Prepared by the author, based on: Goad (1905)

as one large accessible gallery from the surrounding smaller building galleries.

The same 'Okelle' building type spread in all directions, especially toward the irregular Turkish Town, which supposes the functional filtration at the border between the two towns as in the case of Cairo. The 1905 'Insurance Plan' adds two major plazas to 'Place des Consuls' at the opposite poles of 'Rue Nebi Daniel,' which formed the 'Raml Plaza' on the seaside and the 'Railway Plaza' toward 'Kom El Shukafa' where Pompei's Pillar stands, thus defining the tripoles of the European colony.

Meanwhile, the major axis of 'Rue Ibrahim' stretched from the port district to 'Place Des Consuls' where the supportive functions located, in addition to the landmarks of 'Le Bourse' and the mixed 'Tribunal' buildings. The commercial establishments extended from 'Place Des Consuls' along 'Rue Cherif' of European commercial banking buildings and business companies. The area between the triple plazas developed the major public buildings such as Greco-Roman Museum, Zizinea Theater, prestigious hotels, and governmental and apartment buildings.

The new seaside quay of land reclamation along the Eastern Harbor was completed in 1905 by the Italian contractor, Gli Almagia, to form a continuous promenade next to the old Turkish Town. The masonry 'Okelle' buildings surrounding 'Place des Consuls' were of four stories and characterized by uniform façades in Neo-Renaissance style. The height along the Eastern Harbor reached up to six stories of new apartment buildings with ground cafés, which developed neo-Gothic façades in Venetian style of gypsum crafts and mosaic patterns. Nevertheless, the eastern zone of the European Quarter developed Baroque-style masonry houses of white tones in large gardens. Nevertheless, more of Alexandria had gained potential for residential suburbs to

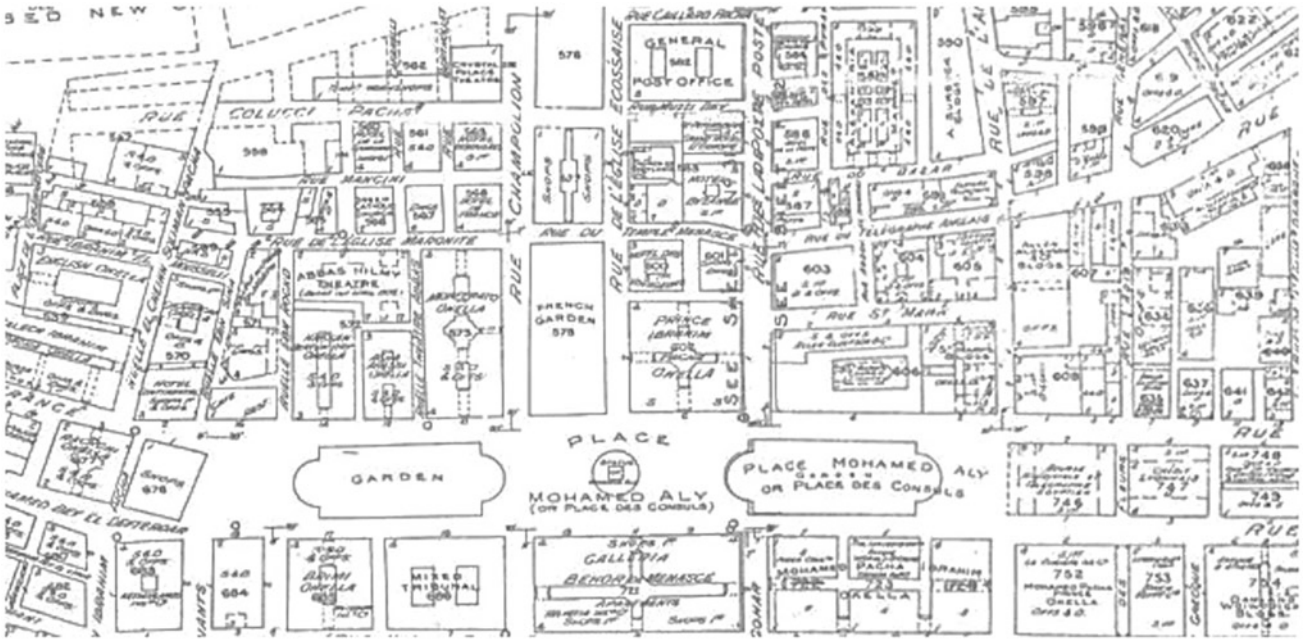

Fig. 9 Sample sheet of Alexandria's 'Insurance Plan' in 1905. Sheets No. 31 & 32 in: Goad (1905)

integrate with the countryside on the Garden City concept, which still bear the names of the European founders such as Zizinea, Stanley, and Lauran. Meanwhile, the southern zone accommodated the dense low-income housing with the narrow alleys regulated 3 m minimum width. The infrastructures of electricity, gas, sewerage, and water networks were all founded by the year 1879 along the streets of the modern town.

The 'Insurance Plan' in 1905 of Alexandria adopted the unified legend of infrastructures and building elements for insurance. The plan of the port district detailed all warehouses and other commercial buildings. Also the downtown area detailed the European building types of hospitals, banks, hotels, religious buildings, Okelles, theaters, municipal buildings such as police and fire stations, apartment buildings, villa houses, in addition to listing more than 60 offices of insurance companies in Alexandria. The ownership identifies names of various nationalities such as Greek, Italian, German, French, and British, which reflects the cosmopolitan character of the European colony. Further plan information details the infrastructures and streets with their names. The detailed town planning system of insurance in 1905 supposes a precaution measure in the aftermath of the British bombardment of the town on July 11, 1882, together with the riots in the following day, which left the European Quarter in complete ruins. The situation is described by E. M. Forster as: '*Rues Cherief and Tewfik Pacha –indeed all the roads leading out of the square- were destroyed, and nearly every street in the European Quarter was impassable through fallen and falling houses. Empty jewel cases and broken clocks lay on the pavements. Every shop was looted ….. and order was slowly restored*' (Forster 1982, p. 101). Consequently, the quantity of building insurance in Alexandria surpassed its counterpart of Cairo, which emphasizes the European interest in Alexandria in terms of both commercial development and the town planning regeneration of the ancient town as well.

Although the municipal byelaws of Alexandria and Cairo were common in many terms such as the street regulations and taxation policies, some special regulations addressed Alexandria. The streets of the port district were regulated by special taxes for the allowed cotton and timber stocks to extend outside the warehouses, except for the streets less than 6 m width, in addition to the major 'Rue Ibrahim' and 'Rue of Mahmoudieh canal' due to the high density of users. The canal, which brought back life to Alexandria, was regulated a special byelaw to prohibit any person from just approaching its course. Above all, the byelaws specified imprisonment for whoever took any kind of antiquity found over the shallow ground of Alexandria (El Kalzah 1907, pp. 269–274).

5 The Insurance Plan of Alexandria at Present

The current situation of Alexandria totally differs from the historical European strategy of Insurance Plan. The major change of landuse is the obsolete port district of total ruins at present without any function or strategy of development for

the empty historical warehouses of huge scale (Figs. 10 and 11). The sudden European exodus left the shipping activities and the warehouses out of use. The redundant port district not only affected the concentrated landuse of shipping and warehouses, but also affected the supporting activities of the European colony itself on the other Eastern Harbor, which destroyed the whole system of landuse integration between the eastern and western harbors. Thus, the landuse of the European socioeconomic activities changed from business offices and cultural activities with the residential quarters into a chaotic mixture of building functions without any zoning criteria as before. Similar to Cairo, the historical open spaces and street network became only vehicular circulation of ever-increasing crowdedness. The core 'Place des Consuls' lost the gallery network of obsolete pedestrian network. Meanwhile, the historical seaside quay promenade transformed into a spinal vehicular street without any pedestrian amenities or tram circulation as before (Figs. 12 and 13).

Fig. 10 Abandoned port district. Photograph at present taken by the author

Fig. 11 Ruined warehouses. Photograph at present taken by the author

The administrative demarcation of current Alexandria totally differs from the Insurance Plan (Fig. 14). The districts of 'Hai Al Gomrok' mix the European colony with the Turkish Town regardless of their different urban structures. Also the districts of 'Hai Downtown' subdivide the historical European colony into different areas with extended parts outside the historical zone without any criteria of demarcation. Meanwhile, the multiple districts of downtown and Gomrok dissolve the special characteristics of each without distinction. This demarcation of only vehicular traffic criteria ignores the differences of urban structure between

Fig. 12 Okelle at present. Photograph at present taken by the author

Fig. 13 Okelle in the past. Photograph collection of: The Alexandria Preservation Trust (http://pharos.bu.edu/Alex/apt/)

Fig. 14 Shattered demarcation of Alexandria's colony at present. Prepared by the author, based on: The Central Agency of Public Mobilization and Statistics (CAPMAS) of Egypt, The GIS Department, 2006

the different historical zones and the present development. The dissolved territories facilitated the dissolution of the historical European colony and the Turkish Town as well. The whole historical areas became subject to the common building laws without distinction between the merits of each historical zone. Meanwhile, the demarcation of the abandoned port district belongs to 'Borg Alarab' which extends long kilometers toward the west of Alexandria without reasoning. This confirms the total neglect of the port district without any strategic belonging or development. Accordingly, the basic issue of different demarcation has greatly affected the original Insurance Plan of interdependent land-use between the port and the downtown colonies.

The shipping businesses that once flourished on the international level have all disappeared and became limited to the local activities, which suffered from comparison with the major seaports in the east (e.g., El Shazly 2003b). Similar to Cairo, the image of Alexandria transformed from the European town planning of outstanding archeological depth into a dense vehicular circulation with the urban form of different redevelopment. The analogical cognitive structure on the city level of historical Alexandria has been destroyed and fragmented without functional planning. The common building and urban laws of Egypt do not differentiate the special characteristics of urban areas in detail, which together with the lack of executive regulations on the city level have ended up in a typical condition of deterioration for the historical European Quarters in Cairo and Alexandria. The same national rent control and the recent transformation to the freed real-estate market do not consider the unique conservation of the historical urban structure in central Alexandria.

The conservation efforts of private and public sectors are limited to the visual aspects of individual sites, without an overview of designating conservation areas or considering the socioeconomic dimension for sustainable development. The most promising effort is the private foundation of Alexandria Preservation Trust since the mid-1980s (The APT Web site), which has been engaged in the documentation of the city development with the monuments and buildings of historical value throughout Alexandria. Although the foundation attempts the conservation of the historical sites in Alexandria with special emphases on the historical European Quarter, the building enforcement and the action plans are constrained due to the wide gap between the governmental policies and building regulations on the one hand, and the attempted conservation by the non-governmental organizations on the other. Furthermore, the Comprehensive Plan Project (Alexandria Governorate 1984), which was set for the new millennium of Alexandria in collaboration between Alexandria Governorate, Alexandria University, and the University of Liverpool, encountered many aspects of the city planning in massive volumes and presentation of existing and future recommendations, but faced difficulties without socioeconomic realization.

The unrecognized policy of building insurance set by the historical Insurance Plan prospects the insurance sector for redevelopment at present. The current practice of insurance is controlled by the state, which affects the competitive market and the new strategies of the insurance sector. In addition, the insurance industry is currently responsible for

less than 1% of GDP, with restrictions on the practice of foreign insurance companies and actuaries (Sherwood 2000, p. 6). The law specifies a penalty of '*A sentence of imprisonment and a fine of not less than FIVE THOUSAND L.E. and not exceeding FIFTY THOUSAND L.E., or either penalty shall be imposed on whoever represents foreign insurance bodies or companies*' (G.A.F.I 1996, p. 46). However, this law confuses with another that states: '*As regards non-Egyptian, in order to record them in the Register they shall be licensed to exercise the profession on submission of the documents specified by the executive Regulations set by the Egyptian Higher Insurance Council*' (G.A.F.I 1999a, p. 40). E. Sherwood clarifies the situation by indicating 'there is a serious skill shortage, with only seven qualified Egyptian actuaries, including one internationally qualified' (Sherwood 2000, p. 6). Meanwhile, the Egyptian Insurance Supervisory Authority is concerned with ensuring the realization of the economic and social objectives of personal, property, and liabilities insurance activity. It is ambiguous that, however, how these objectives are met within the skill shortage of the profession. For example, the properties are evaluated without specifying the detailed criteria such as the historical 'Insurance Plan' documentary. Although the insurance against fire targets the built realities, the practice is limited to the buildings of high risk such as factories without a wider scope of insuring detailed building items.

The foreign ownership of built realities is controlled by the law stating: '*1) The ownership of buildings and vacant lands shall be restricted to at most two realities in all parts of the Arab Republic of Egypt for residence and housing purposes for the non-Egyptian personally and for his own family….. 2) The area of such reality shall not exceed four thousand square meters. 3) The reality shall not be counted within those considered as monuments*' (G.A.F.I. 1999b, p. 26). On the contrary, the incentive of foreign investment is another law permits the ownership of: '*Hotels and Motels, tourist sites and related or complementing services, entertainment, sporting, commercial and cultural activities, as well as completing and expending the respective establishments'* (G.A.F.I. 1997, p. 4). Applying the incentives of foreign investment would relate directly to the merits of the historical European Quarter for conservation and development. Therefore, the restrictions on foreigners for both the insurance industry and the obscured ownership of properties affect the motivation upon which the historical 'Insurance Plan' was first introduced to Egypt.

On another front, the Government specifies the public investment in urbanism as: '*The Ministry of Housing and Reconstruction designates the areas and boundaries of Free Zones, and the projects of industrial, commercial, monetary establishments, tourism, infrastructures and other services in order to upgrade the urban areas of cities'* (The ARE 1987, p. 1). The lack of public funds, however, and the non-profitable real-estate policies proved ineffective to achieve the upgrading objective for the obsolete port district in Alexandria. Moreover, the current governmental incentives to attract private and foreign investment include tax exemption and Free Zone designation. Among the activities conditioned by the law are: '*Exercising the activity of Hotels, Tourist Villages and Tourist Transportation by land, Nile, Sea or Air*' (The ARE 1996, p. 4–5). The law adds the activities of: '*Overseas Maritime Transport of services, goods and passengers outside territorial waters, by using ships and different maritime means of transport like carrier vessels and ferries'* (The ARE 1996, p. 5). While the law perfectly matches the port district of Alexandria, having no clear structure of insurance system and ownership rights may have constrained the foreign investment from rethinking the international role of Alexandria's seaport with its supportive downtown for world business and cosmopolitan society of true 'Free Zone' history.

6 Conclusion

The comparison of the Insurance Plan in Cairo and Alexandria between the colonial and the nationalized eras raises several issues beyond the realized plans for future conservation. The specific issue of territorial demarcation clarifies the administrative role of development with the associated policies of socioeconomic and environmental conservation. The lost territories at present with the cultural change between foreign and native development had forced the historical colony to deteriorate without clear identity. This is clearly demonstrated by the strengthened Insurance Plan through the zoned territories of filtration process from the native town. The resulted segregation of the European Insurance Plan from the native traditional system of development had afforded the opportunity of planning the colony without political issues. Thus, the commercialized landuse for the European socioeconomic sustainability of Cairo and Alexandria with the consistent urban form for each zone of the colony is a major indicator of strengths by the Insurance Plan. Meanwhile, the market forces of the built reality with taxation and the backing up by the system of building insurance were all applicable to the new colony but not the constraint old towns by the Insurance Plan itself.

All of the current national policies to liberate the controlled market and encourage foreign investment with the conservation of the wide urban heritage lack the administrative tools to be put into action plans, especially when compared to the designated sets of historical Insurance Plans. The absolute contrast is found in the first volume of Alexandria's Insurance Plan, where the major strength of

competitive shipping on the international level fell into total neglect. This reflects the administrative deficiency of converting the historical built resource to a future strategy. On the detailed resolution, the gardened open spaces and pedestrian networks have all facilitated the dissolution by the ever-increasing vehicular pollution. In particular, the obsolete galleries of the historical 'Okelle' buildings no longer buffer the common urban structure of the Insurance Plans. For the present situation to convert the constrained decline into opportunities, the threats of administrative fragmentation should be resolved. In this regard, the formation of an independent authority (Trust) to be modeled on the historical municipality with a clear strategy of administrative and socioeconomic development (and not only physical) can regain the powerful indicators of the Insurance Plan as it was.

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On the Spatial Conservation of Roundabout Cairo Using Pitteway Graph

Ali Essam El Shazly

Abstract

The special roundabouts of Haussmann's Cairo are now limited to vehicular overcrowding with a ruined image. Clarifying the spatial structure aims at regaining the non-visual originality of the historical plan. The prospected method of analyzing the pitteway graph network approaches the spatial conservation through interdisciplinary algorithmic and social dimensions. The resulting essence of symbolic royal structure determines the roundabout of 'Abdin Palace' of the shortest universal distance and the most integrative social space of the layout. Meanwhile, the cyclic geometry of 'Tahrir' roundabout optimizes the Eulerian circulation toward the Nile crossing with maximized social control over the vicinity. On the contrary, the opposite roundabouts around the spacious seam of 'Ezbekieh Garden' separate the native town from the new colony through the dissolved social integrity and control, with restricted cycle space from networking on the layout level. However, the roundabout below the high Citadel in old Cairo matches the logic of least spatial integrity and control with the longest universal distance, while maintaining the visual overwhelm over the city.

Keywords

Roundabout Cairo • Pitteway graph • Spatial structure • Conservation

1 Introduction

The year 1867 founded the roundabout colony of Haussmannization in Cairo. The plan transformed the endogenous Arabic irregular town to a new radial pattern, which added richness to the varied cognitive structure in time and space dimensions. The plan was part of the modernization policy for the ceremonial inauguration of the Suez Canal by world monarchies (Mubarak 1889). The other French engineer 'Le Grand' supervised the realized plan of official survey map publication later in 1874 (Fig. 1). The new roundabout colony accommodated European socioeconomic establishments of prosperous cosmopolitan community, which had influenced Cairo's later development with a population of about one million during the turn of the century. Over time the core plan of Haussmann has gained historical values of building and open space typology, in addition to two national rises of independence in 1952 and the recent Arab Spring for the 'Tahrir' foci to mark a symbolic roundabout.

The area at present, however, demarcates Cairo's downtown district of deteriorated image (El Shazly 2003). Previous conservation studies detailed the physical and socioeconomic characteristics without considering the spatial structure of the roundabout network (e.g., Scharabi 1989; Volait 2001; Attia 2013). This study, however, aims at approaching the spatial conservation of Parisian Cairo from the non-visual viewpoint of graph network strategy.

The numerous types of graph differ from one application to the other with various interpretations (e.g., Chartrand 1985; Diestel 2006; Blanchard and Volchenkov 2009). One of the spatial graph resolutions extracts the connectivity of an invisible 'pitteway' graph from the voronoi convex hull, which determines the spatial structure of generator points in process (Okabe et al. 2000). These generator points may represent any urban elements or phenomena of specified location in space. In this study, the roundabout spaces of colonial Cairo represent the generative points located in space for imaginary pitteway graph exploration. The graph explores several dimensions of spatial structure. In one dimension, the stroll from one point to the other addresses the Eulerian graph network. It tests the algorithmic puzzle of experiencing all spatial points in sequence. The objective of Eulerian footstep determines the human cognitive structure of Haussmann's Cairo in contrast to the current vehicular

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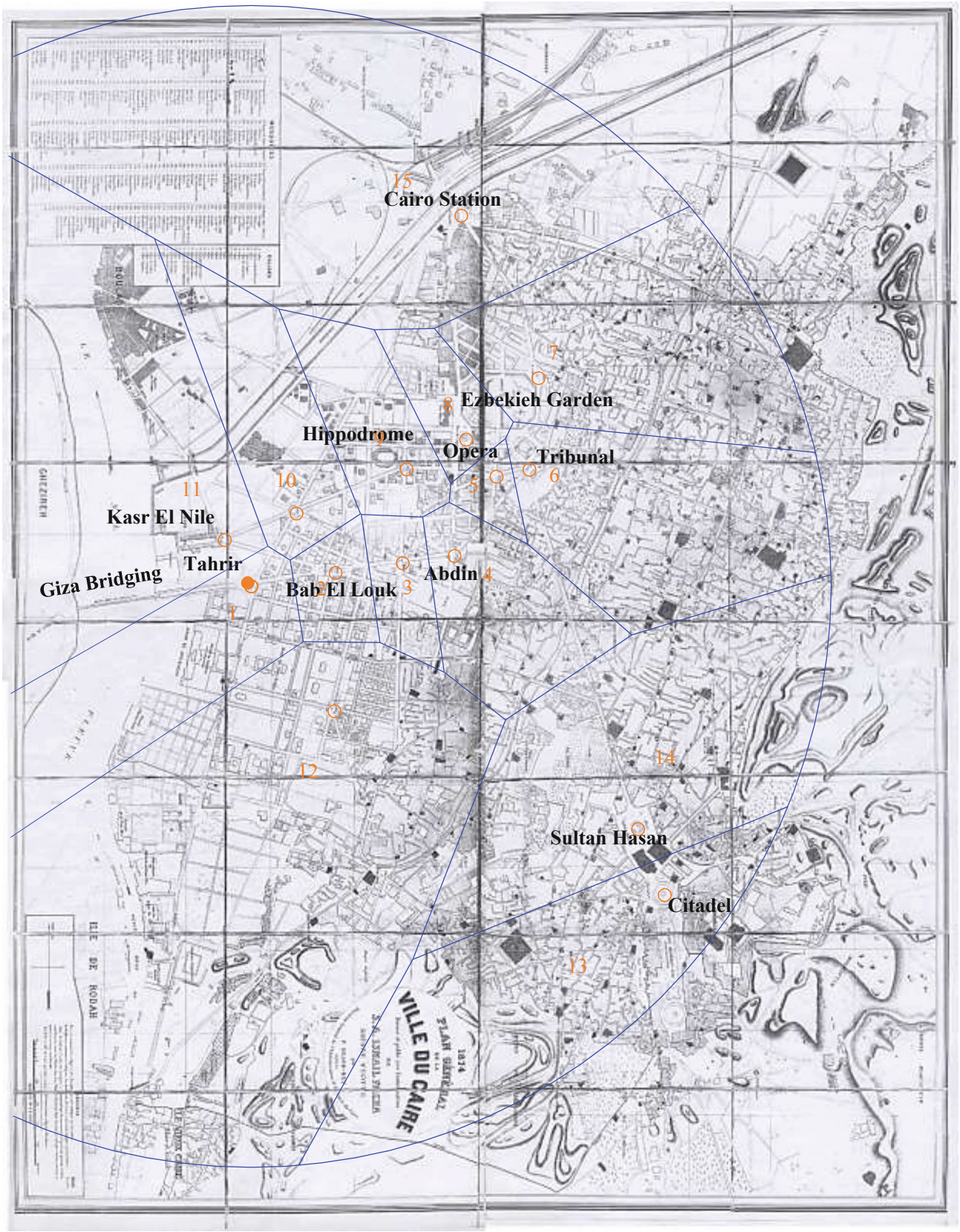

Fig. 1 Roundabout Cairo in 1874. *Source* Survey map of Cairo published in 1874 by the Public Works Department of Egypt under the direction of engineer, Le Grand. The original plan now kept by the Survey Department of Egypt in Cairo, where the official copy obtained by the author in 1995 from the same department for research purposes

adaptation. In another dimension, the social logic of space syntax uses graph layout to measure the global integration of each point in comparison. The more spatial integrity measured for a point (in comparison with all others) reflects its higher social solidarity at the layout level. The whole integral structure of individual points identifies the social logic of spatial composition. Nevertheless, the pitteway graph, being geometrical, allows the measurement of distances between points with exploring the universal distance (the distance of each point to all others) (e.g., Otto 2009).

Further to this introduction, Sect. 2 traces the pitteway graph of roundabout Cairo in digital automation such as using the geographic information system (GIS) software. Other digital programs such as Revit or CAD can produce the same to scale tracing though. The formed pitteway graph explores the spatial network in relationship to the planned characteristics of the study area. Section 3 details the Eulerian property of the generated pitteway graph network for roundabout Cairo. The network investigates the satisfaction of the Eulerian property at different levels of graph resolution. In this regard, the Eulerian possibility is determined at the absolute level of pitteway graph network down to the subgraph components of most efficient (or deficient) Eulerian connection. Section 4 reveals the social dimension of the pitteway graph through the integral measurement of space syntax. The resulted values determine the extent of each point in globally integrating the layout with their average total in general. The integral value in relationship to function indicates the social logic of each point within the composition of the global spatial system. Section 5 further determines the universal distance of the pitteway graph in matrix format. The pairs of graph vertices determine their shortest length along the pitteway graph with their aggregated universal distance. Also the distances among the graph points highlight the critical path of shortcuts in contrast to the farthest distances of less spatial relationship. In conclusion, the correlation of Eulerian, integral, and distance criteria of analyzing the pitteway graph approaches the spatial structure of roundabout Cairo for the benefit of historical conservation.

2 The Pitteway Formation

The geometry of the pitteway graph locates the generator points in space, which here represent the roundabout spaces of Cairo. The connectivity of generator points depends on the spatial tessellation of voronoi convex hull. A simple rule traces the convex spaces of voronoi where the bisecting lines of direct links between every two points are processed for the

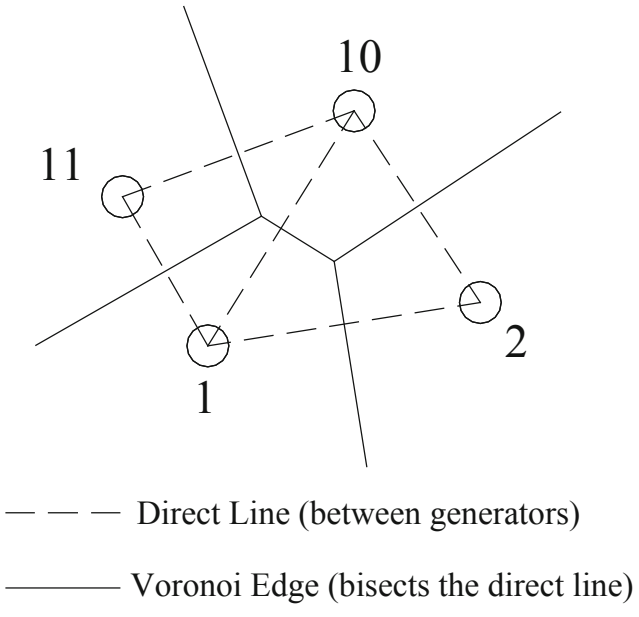

Fig. 2 Step 1 of tracing the voronoi convex hull

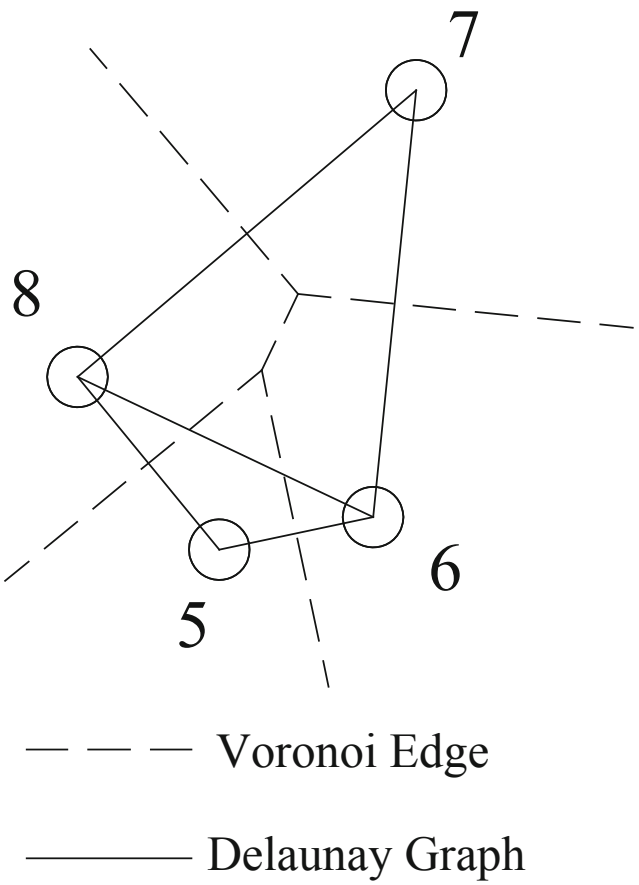

Fig. 3 Step 2 of tracing the Delaunay graph

whole layout (Fig. 2). The direct links are then erased, while the bisecting lines of continuous polygonal shapes result in the voronoi convex hull. Closed inner and open outer polygons characterize the voronoi diagram. Each convex space represents the spatial territory of its generator point, which becomes open to infinity for those located outside. In this process, every two generators sharing a voronoi edge are connected to form the dual Delaunay graph of the voronoi diagram (Fig. 3). Further extraction of the pitteway graph excludes any of the Delaunay edge that does not cross the shared voronoi edge between the two corresponding generator points (Fig. 4). The privilege of the pitteway graph optimizes the spatial relationship of direct connectivity among the voronoi polygons (Figs. 5 and 6). Meanwhile, the overlaid pitteway graph compares and contrasts with the physical plan of roundabout street connectivity for on-ground referencing. Nevertheless, this pilot study not only concerns the historical case of Cairo, but supposes the possible application on other spatial layouts of various objectives including urban conservation. In particular, the geometrical privilege of the voronoi convex hull addresses the space syntax's limitation of non-computable convex

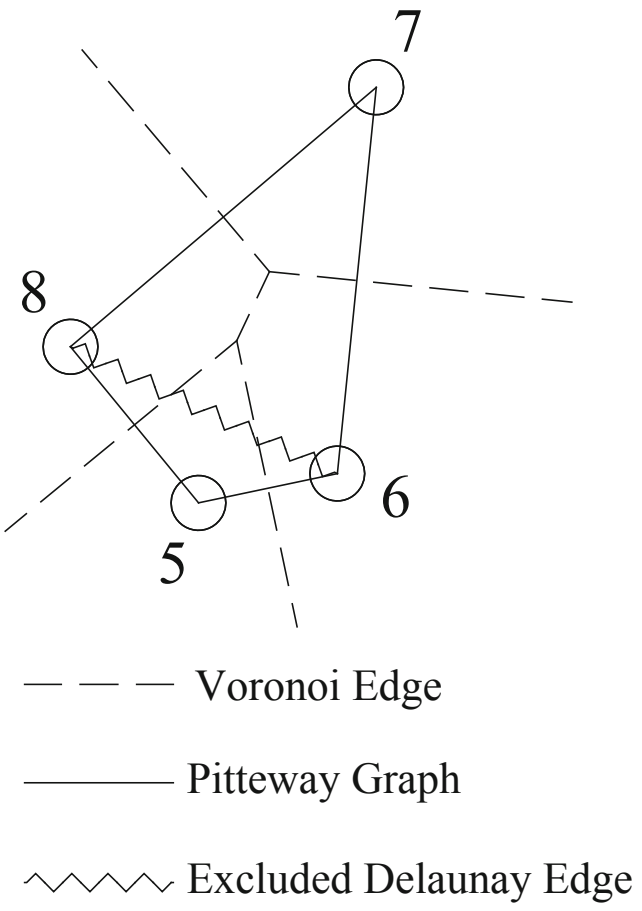

Fig. 4 Step 3 of tracing the pitteway graph

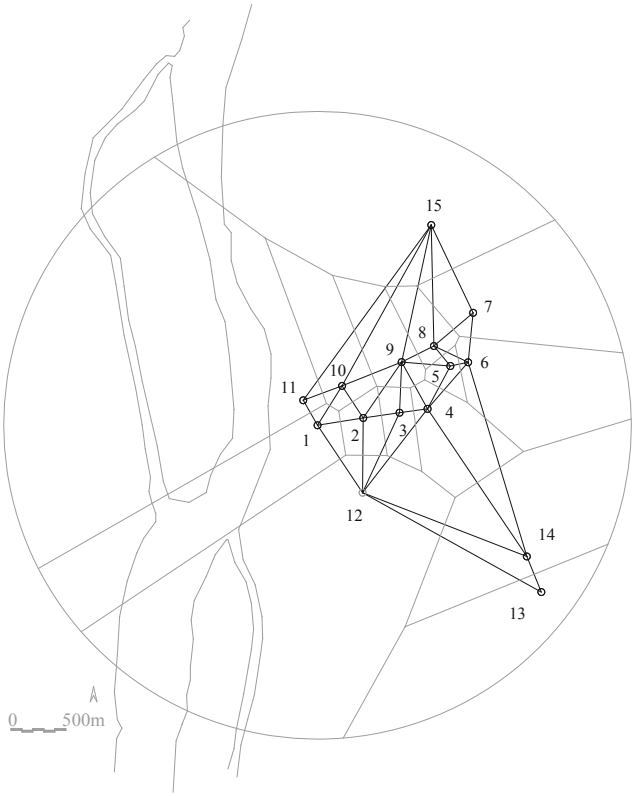

Fig. 5 Delaunay graph of roundabout Cairo

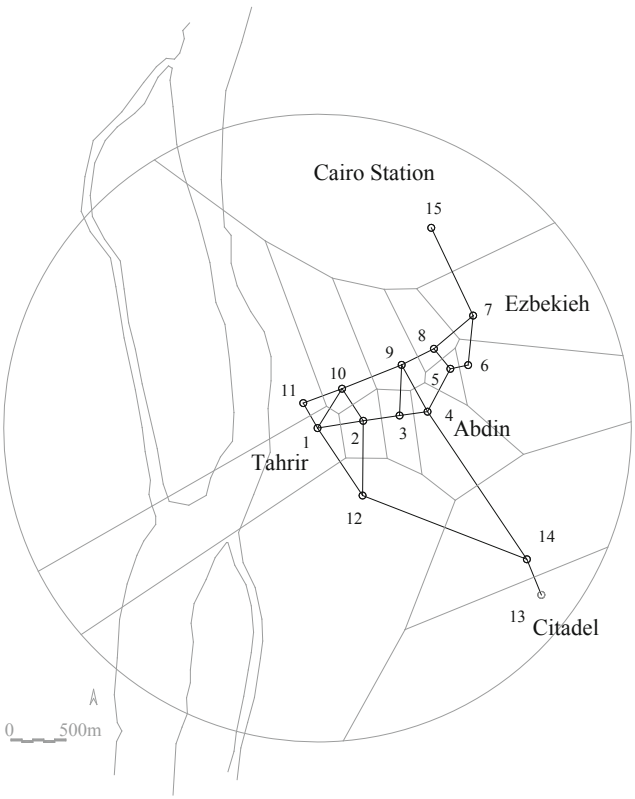

Fig. 6 Pitteway graph of roundabout Cairo

mapping, something which researches have pointed out for methodological development (e.g., Jiang and Claramunt 2002; Batty 2010). While this study supposes one approach of pitteway graph, the future scope of analysis may suggest more tools of graph theory and space syntax in the voronoi diagram of extendable space structure.

The formed pitteway graph is characterized by a dense spatial network along the east–west axis of Cairo. This abstract network represents the planned zigzagging boulevards that stretch toward the Nile edge from the pole of roundabout-1 of 'Tahrir' in connection with roundabouts '11, 10, 2, 12' up to the opposite pole of 'Ezbekieh Garden' with the surrounding roundabouts '5, 6, 7, 8'. The 'Tahrir' pole is characterized by royal palaces along the gardened Nile promenade where generators '1, 11, 12' are located, in addition to the elite chateaux housing that spread in large gardens around the inner generator 2 of 'Bab El Louk' neighborhood. The other socioeconomic pole of 'Ezbekieh Garden' is characterized by roundabout 8 of the Royal 'Opera' and roundabout-6 of 'Ataba' of more landmark buildings such as the mixed tribunal, postal office, fire brigade, and arcaded building blocks of commercial/residential uses. The other corner of generator 7 overlooking the 'Ezbekieh Garden' concentrated the European consulates, missionaries, grand hotels, theaters, and multistory commercial/residential buildings. Between 'Tahrir' and 'Ezbekieh' poles are located generator 9 of the 'Hippodrome' landmark and generator 4 of the governing 'Abdin Palace' royal seat. The crossing axis from north to south observes less pitteway connectivity and few planned boulevards as well. The southern tip is characterized by the two historical landmarks of Sultan Hasan Mosque and Cairo Citadel where the two respective roundabouts 14 and 13 have been planted and connected to Ezbekieh across old Cairo. The northern pole founded Cairo Station in direct link to the Ezbekieh hub.

3 Eulerian Exploration

The unlimited scope of graph theory selects some excursive properties pertaining to the spatial structure of roundabout Cairo. The Eulerian property investigates the possibility of crossing all of the graph edges once in order up to the starting point. Using the trial-and-error method to answer this question, especially for the large graph layouts, would be inapplicable. The graph theory resolves the Eulerian query by specifying: '*A multigraph G is Eulerian if and only if G is connected and every vertex of G is even*' (Chartrand 1985, p. 55). This means every vertex should count an even number of total edges in connection with the other graph vertices. Accordingly, the pitteway graph of Cairo dissatisfies the Eulerian condition, where each of the generators '3, 5, 7, 8, 12, 13, 14, 15' counts an odd number of edges. Despite the non-Eulerian pitteway Cairo in general, the graph components observe specific Eulerian structure for each zone. In particular, the portion of 'Tahrir' exhibits the maximum Eulerian phenomenon except for generator 12. However, the Delaunay graph of 'Tahrir' reverses the process with only generator 12 being Eulerian. In this regard, the 'Tahrir' zone adjusts generator 12 for Eulerian networking on the layout level of the Delaunay graph, but changes at the pitteway level from the global to the local context of true Eulerian structure. On the contrary, the opposite zone of 'Ezbekieh' structures the only generator 6 for Eulerian connectivity on the local context of the pitteway graph, which turns to be non-Eulerian on the Delaunay level of global spanning network.

Between these two extreme structures, the Eulerian Delaunay of generator 5 gains more global context, especially toward the central zone of 'Abdin Palace and Hippodrome' landmarks. Nevertheless, the Eulerian structure of 'Abdin Palace' connects with generator 12 at the Delaunay level, but the 'Hippodrome' switches the Eulerian connectivity toward generator 10 at the pitteway level. Therefore, the 'Tahrir' pole alternates the Eulerian structure between the 'Abdin-Hippodrome' generators at the two graph levels of Delaunay and pitteway to connect on the global context. The 'Ezbekieh' pole, however, continues the filtration process between old and new Cairo through the non-Eulerian connectivity except for generator 5 of common commercial function at the Delaunay graph level. Also Cairo Station dissatisfies the Eulerian property on both local and global contexts of the two graph levels for more independence, but the Citadel pole exchanges the Eulerian structure between generator 14 and generator 4 of the pitteway graph by generator 13 and generator 12 of the Delaunay graph to sustain the global networking of royal edifices. Overview of the Eulerian graph structure embeds minor networks within the global constraint of crossing all edges in a single path, especially for the extracted Eulerian connectivity among the royal destinations.

Besides the Eulerian graph property, the analogous concept of traversable graph determines whether there exists a graph trail containing all vertices and edges of the layout or not. The theorem of resolving this algorithm specifies: *'A multigraph G is traversable if and only if G is connected and has exactly two odd vertices. Furthermore, any* Eulerian *trail of G begins at one of the odd vertices and ends at the other odd vertex'* (Chartrand 1985, p. 58). Again the pitteway graph of roundabout Cairo could not be traversed where more than two vertices have odd degree. The same applies to the Delaunay graph of no traversing possibility. In particular, the pitteway graph observes the mid-zone obstacles of odd-degree vertices along the generator set '3, 5, 7, 8, 12' and extends to the wider zone of '13, 14, 15' end points. The

selection of any two of them may suggest the traversable ends on the subgraph level. The start from any one point and following the traversable principle requires the suppression of several vertices to end up successfully. In this process, the optimum solution either forms as large a cycle as possible, or the longest path possible with knotted cycling; otherwise, the graph is non-traversable. The explored traversing from generator 12, which is the only odd degree at the 'Tahrir' pole, toward the furthest point possible fails to cross any of its neighboring generators in the pitteway graph. For example, the traverse from generator 12 to the nearby generator 3 of similar odd degree, with even-degree vertices for in-between 'Tahrir' generators, satisfies the algorithm. But the suppression of other vertices of the layout causes some of the even-degree vertices to turn into odd, thus obstructing the flow. When examining the same traverse from a larger perspective, someone may select the course of generators '12, 1, 11, 10, 9, 4, 14, 12, 2, 1, 10, 2, 3' of 'a-l' edges in sequence, which by any means of alternative routes misses the '3–4' edge, thus counted unsatisfactory (Fig. 7). Comparably, the 'Ezbekieh' pole could not traverse beyond its simple cycle by more than one generator in any direction of the pitteway graph. Also the layout generators could not traverse the 'Ezbekieh' cycle due to its odd-degree vertices, whereas the only generator 6 of even degree is disconnected from any other generator than the 'Ezbekieh' cycle. Meanwhile, the single connectivity of the two poles of Cairo Station and the Citadel to the next vertices of odd degree gives no pitteway opportunity for a traversable graph. Therefore, the allover restricted traversing leaves the only choice of suppressing some graph vertices for simple cycles of varies sizes or linear routes with tanging cycles.

Furthermore, the Hamiltonian property of graph theory investigates the possibility of crossing all of the roundabout vertices once in sequence. In definite response to this question, the algorithmic theorem specifies: '*If G is a graph of order p (≥ 3) such that deg v ≥ p/2 for every vertex v of G, then G is Hamiltonian*' (Chartrand 1985, p. 69). Apart from this conditional requirement, some other graphs can still hold the Hamiltonian conformity such as the graph of a simple cycle. Whence unlike the Eulerian case, the

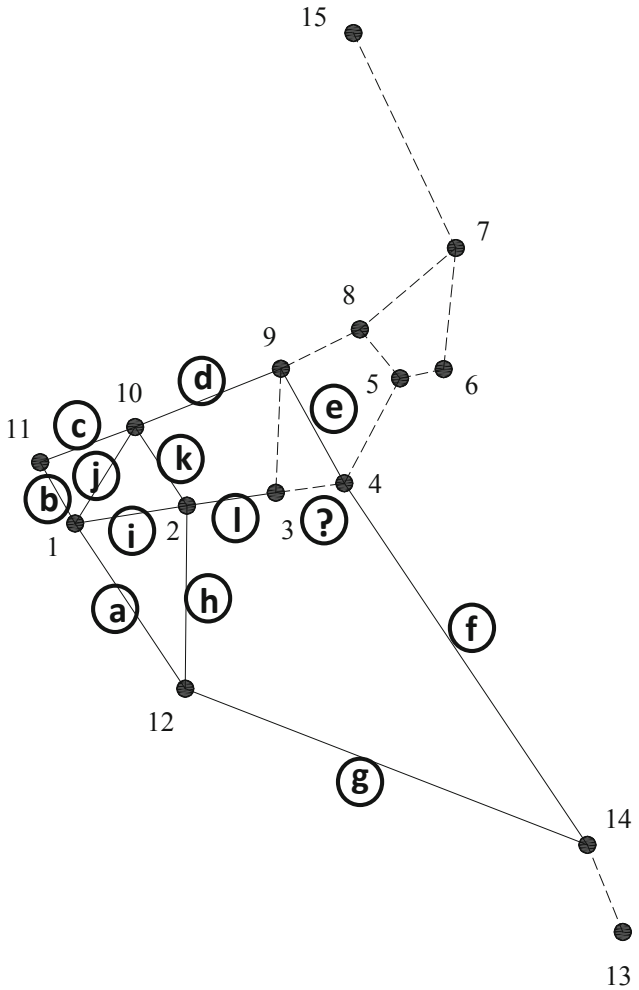

Fig. 7 Traverse network

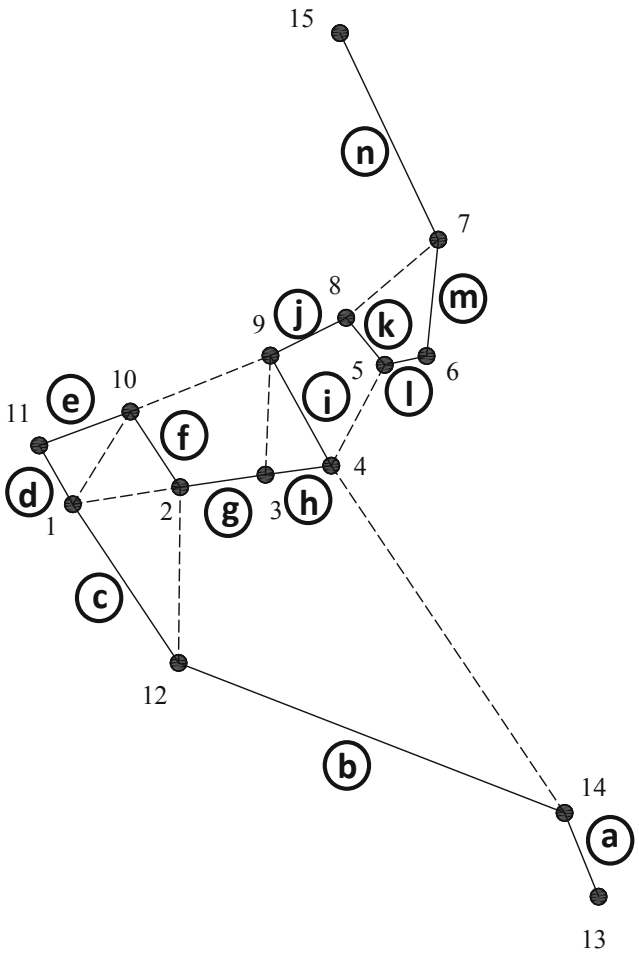

Fig. 8 Hamiltonian network-1

Hamiltonian proof extends to the trial-and-error method of determination beyond the stated condition. Since not each of the pitteway vertices has a degree greater than or equal to half of the graph order, roundabout Cairo has to search for other options to satisfy the Hamiltonian property. In one trial, starting from one of the two graph bridges of the Citadel or Cairo Station, it is possible to follow the Hamiltonian course of '13, 14, 12, 1, 11, 10, 2, 3, 4, 9, 8, 5, 6, 7, 15' generators of '*a*–*n*' edges in sequence (Fig. 8). Another trial may select the alternative Hamiltonian sequence of generators '13, 14, 4, 3, 2, 12, 1, 11, 10, 9, 8, 5, 6, 7, 15' of '*a*–*n*' edges as well (Fig. 9). Any other trial will end up dissatisfying the Hamiltonian algorithm regardless of the generative start point. Several observations of the detected Hamiltonian pitteway courses can be pointed out as a rule of thumb. First, one must start or end at any of the two opposite graph bridges of the Citadel or Cairo Station; otherwise, the network is not Hamiltonian. Second, the edge of '9–8' is a must for the Hamiltonian network in both possible courses. Third, the pitteway's zigzagging structure of the 'Tahrir' pole up to the 'Abdin-Hippodrome' generators affords the alternating sequence of the two Hamiltonian courses, whereas the 'Ezbekieh' pole has only one route of '8, 5, 6, 7' generators in two-way direction. Thus, the Hamiltonian navigation of roundabout Cairo emphasizes the vista of the high Citadel up to the railway terminal with the pivotal structure of generator 9 between the single choice of 'Ezbekieh' and the more flexible 'Tahrir' pole.

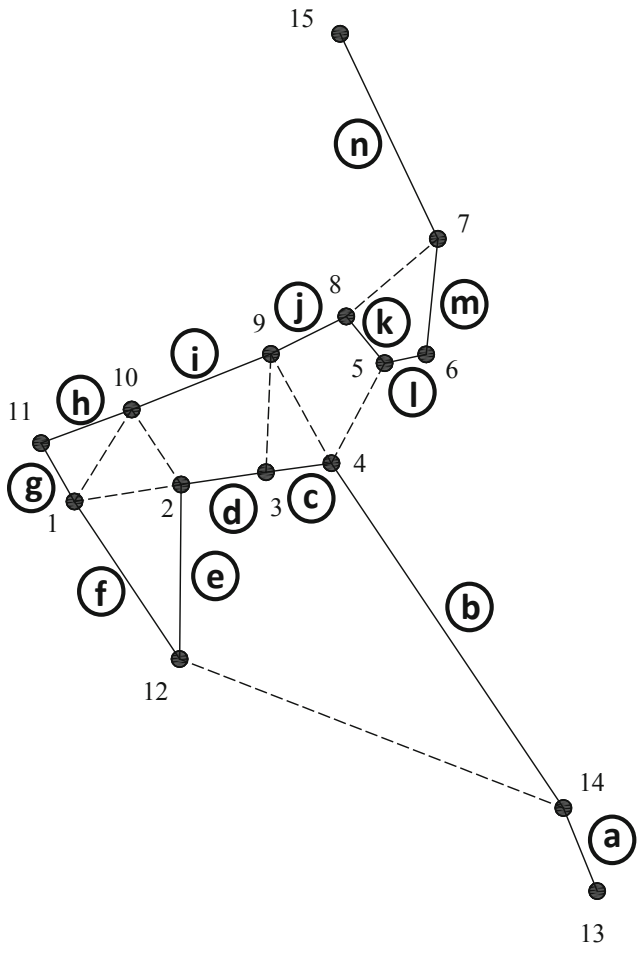

Fig. 9 Hamiltonian network-2

A further issue of the pitteway graph observes the degree of each generator in relationship to the indirect connectivity, thus the difference between the pitteway graph and its Delaunay predecessor. The maximum degree of the pitteway graph observes four edges for each of the generator set '1, 2, 4, 9, 10' to form a connected subgraph. The cluster of '1, 2, 10' generators at the 'Tahrir' pole forms a cyclic triangle versus the linear connectivity of '4, 9' generators between the 'Hippodrome' and 'Abdin' palace with the longest edge '9–0' connecting the two clusters. Despite the cyclic privilege, the two generators of linear connectivity are characterized by more indirect links of two edges for generator 4 and three edges for generator 9 compared to a single edge for each of the generators '2, 10' and none for generator 1 of 'Tahrir' itself. In this regard, the 'Abdin-Hippodrome' relationship is privileged by more connectivity at the level of the Delaunay graph, but the 'Tahrir' pole gains more potential at the pitteway level through the cyclic space. This observation is enforced by the Delaunay triangulation of maximal seven cycles for generator 9 and followed by six cycles for generator 4, which are more than any other of the layout. Also the Delaunay's cyclic triangles of generator 9 connect with the 'Tahrir' cluster through the shared edge '2–10' of extendable cyclic space. Meanwhile, generator 4 connects with generator 12 to form another Delaunay opportunity of 'Tahrir' linkage through the larger cyclic triangle of '1, 4, 12' beyond generators '2, 3' of 'Bab El Louk' plazas. Although the pitteway's absence of '4–12' edge terminates the cyclic connectivity, the same generators '2, 3' continue the shortcut connectivity between 'Abdin' and 'Tahrir' ends. Accordingly, the in-between role of 'Bab El Louk' plaza maintains the 'Abdin' belonging to 'Tahrir' at both graph levels from the cyclic Delaunay triangles down to the shortest pitteway connectivity.

The less degree of three edges composes the generator set '3, 5, 7, 8, 12, 14' of disconnected subgraph. The cluster of '5, 7, 8' generators forms a connected graph component at the 'Ezbekieh' pole, though of no cyclic space. A smaller component forms the lengthy '12–14' edge connectivity between the 'Citadel' and 'Tahrir' ends. However, the individual generator 3 of Bab El Louk zone is left halfway between the two connected components. Despite the limited linkage, the overall pitteway structure of tridegree shifts the 'Tahrir' interconnectivity toward the 'Ezbekiah' network. Nevertheless, the longest edge of 'Tahrir' component

emphasizes the polar connectivity rather than the locality of 'Ezbekieh' graph. This is further emphasized by the leftover generator 3 that relates to neither the local context of 'Tahrir' as before nor the gained networking potential of 'Ezbekieh' pole. The indirect Delaunay edges enforce the observed structure through the maximal three edges of generator 12 with more spanning options compared to the 'Ezbekieh' generators of less indirect edges in stock. In another perspective, the strategy of 'Tahrir' connectivity allocates generator 12 for a centralized layout spanning, whereas the 'Ezbekieh' case decentralizes the spanning structure among the plural generators of the core gardened space. The former concentrates the opportunity of developing the still underdeveloped lands along the Nile, while the latter graph maximizes the filtration process of old from new Cairo at the 'Ezbekieh' meeting spot.

The lesser pitteway degree of two edges points out the two generators '6, 11' of 'Ezbekieh' and 'Tahrir,' respectively. The indirect edges of generator 6 surpass the direct ones, but generator 11 is limited to only one edge. Although the 'Tahrir' structure sustains the centralization role of generator 12, the other side of 'Ezbekieh' reverses the process through generator 6 of optimized degree. Therefore, the dual structure of 'Ezbekieh' had awaited the degree-two pitteway graph of generator 6 to perform the centralizing role at the layout level of the Delaunay graph, which turns into a decentralized strategy at the pitteway resolution. The minimal degree one of generators '13, 15' highlights the two respective poles of the Citadel and Cairo Station. Despite their similarity of pitteway's bridge structure, the Delaunay network differentiates between the multiple connectivity of Cairo Station versus the limited Citadel links. The former affords all possible shortcuts through the indirect links to reach the bulk of railway services at the congestion-free outskirts, while the extruded level of the latter deploys the closest generator 14 for the layout connectivity on ground.

4 Integral Syntax

The social dimension of the voronoi convex hull addresses the space syntax of integral measure along with the spatial control using the pitteway graph approach (Table 1). The classification of spatial integration calculates the depth of each space in relationship to all others, where the lower the resulted value the higher the global integration of that space for the whole layout (Fig. 10). This depth measure of integration for each space is calculated according to the relative asymmetry of space syntax as:

$$\text{Relative asymmetry (RA)} = \frac{2(\text{MD} - 1)}{K - 2}$$

Table 1 Space syntax measures

Gen.	Integration	Control	Degree	Indirect E
1	0.1538	0.9	4	0
2	0.1208	1.0095	4	1
3	0.1318	0.6761	3	1
4	0.0989	1.2595	4	2
5	0.1428	0.7095	3	1
6	0.1428	1.2	2	3
7	0.1758	0.6	3	0
8	0.1318	1.1261	3	2
9	0.0879	1.5	4	3
10	0.1318	1.1261	4	1
11	0.1868	0.65	2	1
12	0.1208	1.6166	3	3
13	0.2197	0.4166	1	1
14	0.1428	1.0333	3	1
15	0.1428	1.2095	1	4
Ave.	0.1421	1.0022	2.93	1.6

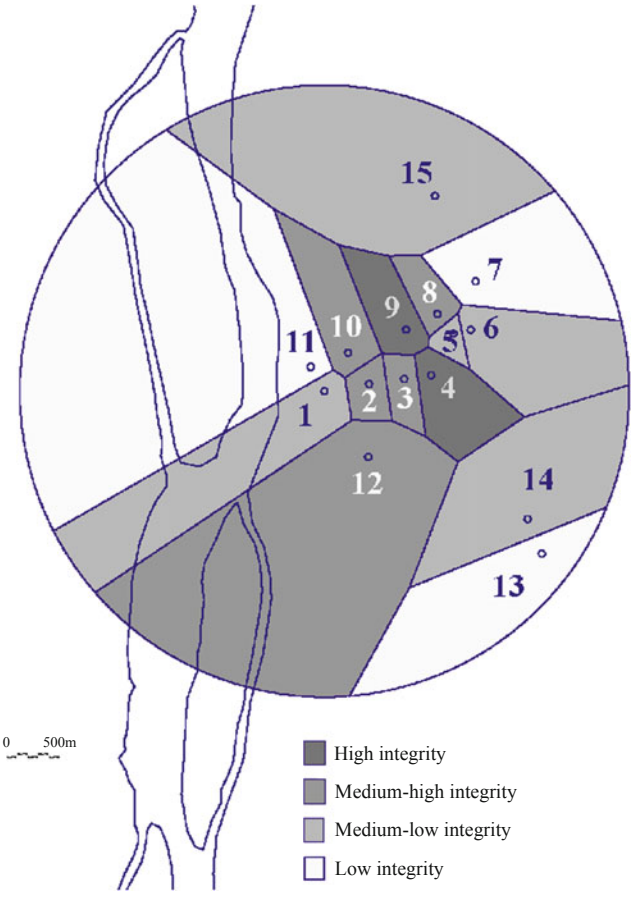

Fig. 10 Spatial integration

where 'MD' is the mean depth and '*K*' is the number of spaces in the spatial system (Hiller and Hanson 1984, p. 108). Meanwhile, the higher value of calculated spatial control of a space indicates more distributive network over the surrounding spaces (Fig. 11). This calculation follows a simpler process, where each space sums up the received fractions of the equally subdivided 'one' integer from all adjacent spaces to give the control value of that space (Hiller and Hanson 1984, p. 109). The most integrating 'Hippodrome' of generator 9 scores the lowest '0.08' value. An almost similar value of '0.09' corresponds to generator 4 where 'Abdin Palace' is located. Both generators are characterized by high control values of '1.5 and 1.25', respectively, as well. In this regard, the two generators globally integrate the roundabout structure, while also locally control the distributive network over the surrounding generators. This symbolizes the royal structure as of overwhelming integrity and control, whereas the largest public facility of the 'Hippodrome' reflects the social integrity among the elite European population of various nationals. On the contrary, the most disintegrative space of generator 13 scores the highest value of '0.21' with the least control value of '0.41'. Therefore, the far-ended 'Citadel' of the highest topography

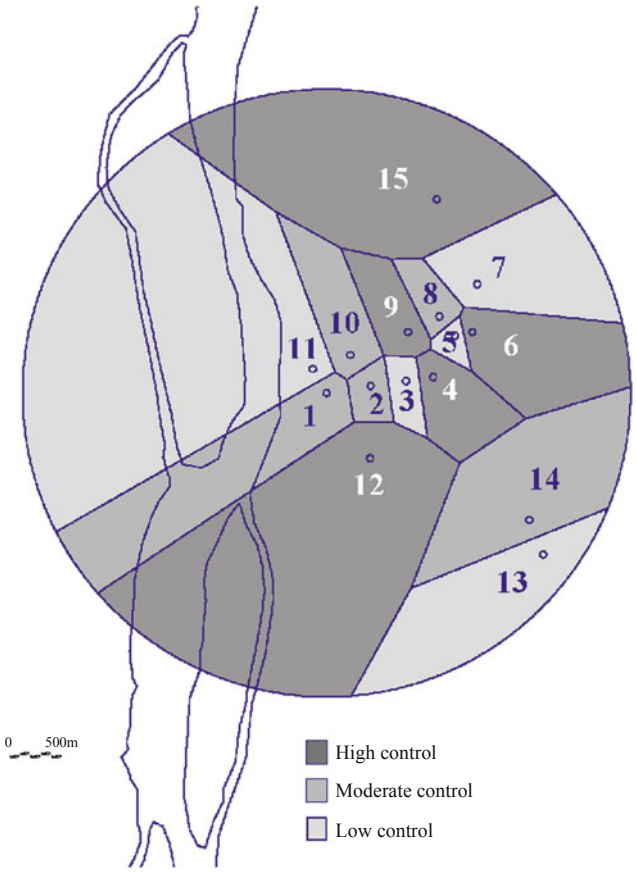

Fig. 11 Spatial control

over Cairo integrates visually rather than on the ground. The average integration of '0.14' for the whole layout is met by the generator set '5, 6, 14, 15' of constant integral value. While the central roundabouts of 'Ezbekieh' are normal for average integrity between old and new Cairo, the other two opposite generators highlight the importance of 'Cairo Station' and the historical landmark of 'Sultan Hasan Mosque' as of common integrity to the widest city structure. However, the control syntax differs in the controlling generators '6, 15' and the controlled generator 5 with the neutral generator 14 between the two extreme values. Accordingly, the same 'Ezbekieh' zone distributes the connectivity into major open spaces of stretching-out links such as generator 6 of 'Ataba' and less distribution for the minor generator 5 inwards, provided that the distant old Cairo stands fair toward the roundabout scheme.

The cluster of 'Tahrir' pole demonstrates more or less average integrity for the generator set '1, 2, 3, 10, 11, 12' of maximal connectivity among each other. The same integral observation adds the couple of generators '7, 8' on the border of the central 'Ezbekieh Garden' at the opposite pole. The above average integral measures of generators '1, 7, 11' are characterized by low control values. However, the below average values of more integrity differ between generator 3 of low control in comparison with generators '8, 10, 12' of higher control with the other generator 2 having neutral measure. In particular, generator 12 acquires the highest spatial control over the vicinity when compared to all others of the layout. Thus, the optimal control of generator 12 represents the distributive gateway toward several royal palaces on the Nile at the 'Tahrir' pole and the distant 'Abdin Palace' as well. Nevertheless, most of the royal establishments such as the royal hospital, school, and institutional facilities are found in the same zone of generator 12 to form a royal quarter along the Nile gardens. This finding further extends through the direct pitteway link of generator 12 with the other prestigious royal palace of 'Helmeyah' where the earlier royal landmarks had been built toward the historical 'Cairo Citadel' pole of attraction.

Nevertheless, the local context of 'Ezbekieh' pole emphasizes generator 8 of the 'Opera' as of more integrity and distributive role than the other generator 7 of major hotels fronting the central garden. These two generators, however, are limited to being drop-offs for the major public buildings without spatial radiation. Also the other two corners of 'Ezbekieh Garden' are characterized by chamfered open spaces in front of public buildings without geometrical roundabouts. In specific, the mixed tribunal landmark building overlooks both the central garden and generator 6 of 'Ataba' that radiates on the city level. Therefore, the special analogical structure of 'Ezbekieh' pole composes one large roundabout that is surrounded by smaller ones at different levels from the city resolution down to the drop-off

level of landmark buildings. This allows the wide variety of integral and control logic to take place from one roundabout generator to the other. Particularly, generator 6 increases the control on the city level of radial boulevards compared to the decreasing values on the individual building drop-offs, while the integral measure is maintained around average of the whole layout scheme. Thus, the logic of both contexts of 'Tahrir' and 'Ezbekieh' varies the control measure for each generator, but measures a stable average integrity for the global structure.

5 Universal Distance

The abstract distance measurement of direct links in the pitteway graph compares the functional connectivity of roundabouts (Table 2). At the layout level, the universal distance aggregates the graph edges of shortest path from each generator to all others in sequence. Meanwhile, the possibility of cyclic spaces in the pitteway graph parallels the spatial 'ringiness' property of space syntax, which enforces the spatial integrity among the generator set in comparison. The measured edge length varies from 120 m to over a kilometer in range. The length interval of 100 m subdivides the edge set into '5–6, 5–8, 3–4, 1–11' of 100–200 m, '8–9, 2–3, 2–10, 13–14, 10–11' of 200–300 m, '1–2, 1–10, 4–5, 6–7, 3–9, 7–8, 4–9' of 300–400 m, '9–10, 2–12' of 400–500 m, and '1–12, 7–15, 12–14, 4–14' of 500 m and longer (Fig. 12). The shortest interval concentrates toward the socioeconomic node of Ezbekieh to form the cluster of roundabouts in a pedestrian reach. The longest interval, however, cuts through old Cairo from the same point of Ezbekieh up to the historical Citadel of new royal establishments. In this regard, the edge length attempts to filter old Cairo from the modern European town through the dense interface of the Ezbekieh zone. Nevertheless, the majority of intermediate lengths are found in the middle zone, which ends up in 'Tahrir Roundabout' where the new bridge crosses the Nile toward the Giza suburbs. The length of the particular edge '4–9' is nearest to the total average of 391 m. This qualifies the two respective roundabouts of 'Abdin Palace' and the major public 'Hippodrome' to represent the whole scheme through the average edge length.

Table 2 Pitteway edge length

Edge	Length (m)
1–2	303.96
1–10	304.78
1–11	189.18
1–12	532.78
2–3	241.15
2–10	252.67
2–12	490.9
3–4	185.7
3–9	332.91
4–5	318.73
4–9	351.29
4–14	1169.07
5–6	119.59
5–8	170.03
6–7	326.66
7–8	337.73
7–15	638.87
8–9	236.83
9–10	421.48
10–11	272.01
12–14	1158.08
13–14	252.8
Ave.	391.24

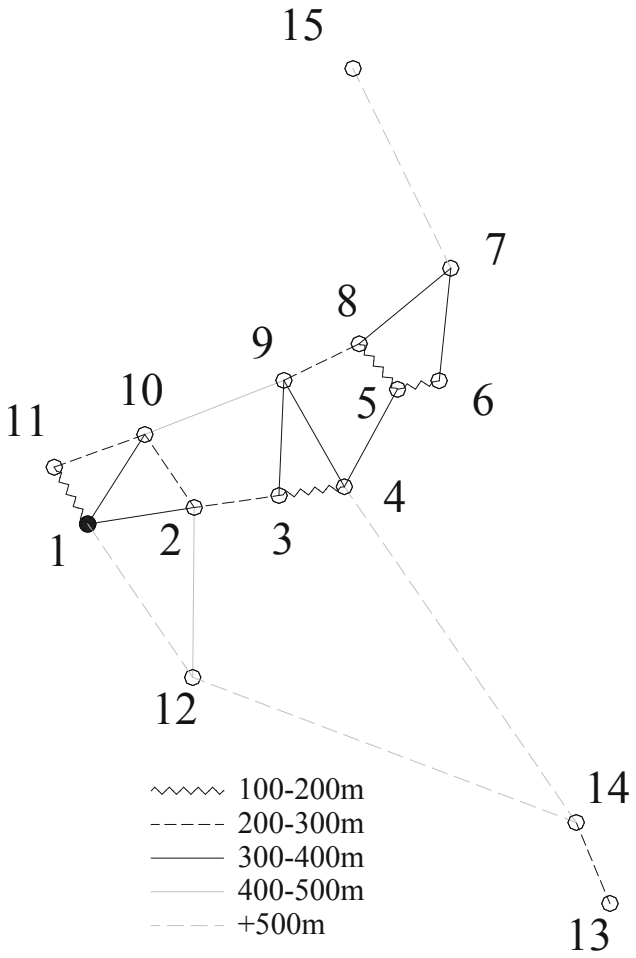

Fig. 12 Edge length

The cyclic space further clarifies the functional connectivity of pitteway edges (Table 3). Among all generators, only the first roundabout of 'Tahrir' preserves the absolute triangulation from Delaunay down to pitteway connectivity. Although the 'Hippodrome' has the highest degree at the Delaunay level, the pitteway graph maintains a single triangle in conjunction with 'Abdin' generator. Meanwhile, the triangular edges '1, 2, 10' and '3, 4, 9' are surrounded by cyclic spaces from all sides of the concentric structure. The net triangles count four cycles compared to three quadrangles and one tetragon edges. The latter cycle connects to the 'Citadel' of generator 13, while the 'Ezbekieh' quadrangle projects to 'Cairo Station' at the opposite end. The two major landmarks, thus, define the terminal vistas of cyclic spaces. This is planned in reality by the two respective boulevards of 'Claude Bey' and the axial extension of 'Sultan Hasan' thoroughfare. The perimeter of pitteway's cycles increases from the minimal triangles to the wider spaces, except the lengthier triangle '1, 2, 12' than the quadrangles. The area, however, shifts the cyclic order of this longest triangle toward the average quadrangle. The ratio of area to perimeter further shrinks the same triangle below average. Comparably, the swap of geometrical order occurs between the other 'Tahrir' triangle of '1, 2, 10' and the central '3, 4, 9' triangle of 'Abdin-Hippodrome' vertices. All other cycles maintain the geometrical measurements in order, which determines the floating geometry of 'Tahrir' triangles over the pitteway network. Nevertheless, the dynamic pitteway graph extends up to one super cycle composed of shorter subcycles without having to repeat any of the circuiting vertices. Phenomenal pitteway cycles, thus, enforce the roundabout integral structure at different connectivity resolutions.

The trail of a pitteway walk, which does not repeat any of its edges, determines the spanning distance among generators (Table 4). The shortest walk between generators '1, 7' that spans the east–west roundabout structure measures 1.3 km in length. The crossing direction, however, has a doubled walking distance from the Citadel up to Cairo Station, though of equal roundabout vertices. The specific generator set '12, 4, 7' limits the distributed paths along this longer axis in contrast to the zigzagging stroll of distributed structure form 'Tahrir' to 'Ezbekieh' poles. The axial intersection at generator 4 represents the pivotal path of shortest universal distance to reach the total generator set. On the contrary, the paths from generator 13 to all others measure the longest distance, which is followed by generator 15 at the opposite end. Nevertheless, the distance from generator 7 of 'Ezbekieh' approaches the total average in comparison with 'Tahrir' of below average value. This qualifies generator 1 as the most distributive polar end of Cairo's roundabouts. Meanwhile, the least universal distance per generator divides into subsets of various ranges. The shortest range forms the generator set '3, 4, 9' in one clustered zone. Longer distances add the set of '5, 8, 2' generators that surrounds the shortest range. Further distances extend outwards to form the set '6, 10, 1' and are followed by the outermost set of '11, 7, 12' in range. Moreover, the longest set '14, 15, 13' encircles the furthest distance of pitteway circulation. In this regard, the universal distance forms concentric structure from the central 'Abdin' generator toward the surrounding shortcut distribution.

Besides, the total average of 14.6 km is nearest to the distance of each of generators '7, 11' at the respective 'Ezbekieh-Tahrir' opposite poles. This emphasizes the east–west spanning of roundabout Cairo with the 'Abdin' milestone along the way. Another distinctive roundabout is generator 12, without which the generators of 'Tahrir' pole would have been far beyond the average universal distance due to its direct link to the 'Citadel' pole. In fact, this link of pitteway graph has been realized by extended boulevards from the end point of the Citadel toward meeting the east–west axis of roundabout Cairo in both direct and rectilinear reach as well. This adds to the spatial process of filtering the old irregular from the new radial Cairo without losing the universal network connectivity of virtual and real structure as well. Nevertheless, the distance measure of the pitteway graph determines further graph resolutions down to the most

Table 3 Pitteway cycles

Cycle space	Order	Perimeter (m)	Area (m^2)	A/P
(1, 2, 10)	3	861.41	34,983.35	40.61
(1, 2, 12)	3	1327.63	73,571.68	55.42
(1, 10, 11)	3	765.97	25,381.08	33.14
(2, 3, 9, 10)	4	1248.21	91,608.76	73.39
(3, 4, 9)	3	869.9	30,421.5	34.97
(4, 5, 8, 9)	4	1076.89	66,573.79	61.82
(5, 6, 7, 8)	4	954.01	47,317.98	49.59
(2, 3, 4, 14, 12)	5	3244.89	490,613.16	151.2
Ave.	3.625	1293.61	107,558.9	62.52

Table 4 Universal distance of pitteway graph

Gen.#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Sum (m)
1		303.96	545.11	730.81	1049.54	1169.13	1300.82	963.09	726.26	304.78	189.18	532.78	1943.21	1690.86	1939.69	13,389.22
2	303.96		241.15	426.85	745.58	865.17	1148.61	810.88	574.05	252.67	493.14	490.9	1901.33	1648.98	1787.48	11,690.75
3	545.11	241.15		185.7	504.43	624.02	907.46	569.73	332.9	493.82	734.29	732.05	1607.12	1354.77	1546.33	10,378.88
4	730.81	426.85	185.7		318.73	438.32	764.98	488.76	351.29	679.52	919.99	917.75	1421.42	1169.07	1403.85	10,217.04
5	1049.54	745.58	504.43	318.73		119.59	446.25	170.03	406.86	828.34	1100.35	1236.48	1740.15	1487.8	1085.12	11,239.25
6	1169.13	865.17	624.02	438.32	119.59		326.66	289.62	526.45	947.93	1219.94	1356.07	1859.74	1607.39	965.53	12,315.56
7	1300.82	1148.61	907.46	764.98	446.25	326.66		337.73	574.56	996.04	1268.05	1639.51	2186.4	1934.05	638.87	14,469.99
8	963.09	810.88	569.73	488.76	170.03	289.62	337.73		236.83	658.31	930.32	1301.78	1910.18	1657.83	976.6	11,301.69
9	726.26	574.05	332.9	351.29	406.86	526.45	574.56	236.83		421.48	693.49	1064.95	1772.71	1520.36	1213.43	10,415.62
10	304.78	252.67	493.82	679.52	828.34	947.93	996.04	658.31	421.48		272.01	743.57	2516.28	2263.93	1906.92	13,285.6
11	189.18	493.14	734.29	919.99	1100.35	1219.94	1268.05	930.32	693.49	272.01		721.96	2132.39	1880.04	1906.92	14,462.07
12	532.78	490.9	732.05	917.75	1236.48	1356.07	1639.51	1301.78	1064.95	743.57	721.96		1410.43	1158.08	2278.38	15,584.69
13	1943.21	1901.33	1607.12	1421.42	1740.15	1859.74	2186.4	1910.18	1772.71	2516.28	2132.39	1410.43		252.35	2825.27	25,478.98
14	1690.86	1648.98	1354.77	1169.07	1487.8	1607.39	1934.05	1657.83	1520.36	2263.93	1880.04	1158.08	252.35		2572.92	22,198.43
15	1939.69	1787.48	1546.33	1403.85	1085.12	965.53	638.87	976.6	1213.43	1906.92	1906.92	2278.38	2825.27	2572.92		23,047.31
Ave. (m)	956.37	835.05	741.35	729.79	802.8	879.68	1033.57	807.26	743.97	948.97	1033	1113.19	1819.93	1585.6	1646.24	14,631.67

abstracted graph of the Euclidean minimum spanning tree (EMST) in subsequent extractions of graph resolutions. These graph extensions can take the research to an unlimited scope of inferred spatial structure of algorithmic network properties. Meanwhile, the continual link of the infinite graph representations to the extensive social scope of logical space syntax and the universal informatics of voronoi geometry together justify the methodological essence of this initiated study toward an endless scope of future research advancement on non-visual spatial structure, which could only be correlated in conclusion through the interdisciplinary graph approach.

6 Conclusion

The network operations conducted in this study on the pitteway graph of historical roundabout Cairo attempt to deduce the invisible spatial structure from various perspectives in correlated approach. Each zone of the roundabout scheme adjusts the spatial measurements and the circulative network in relationship to the different old Cairo of irregular pattern, thus the diverse spatial structure at different levels of resolution. In this regard, the segregation of the regular colony from the endogenous town demonstrates non-visual tracking and social dimensions beyond the physical context for conservation. On the layout level, the non-Eulerian algorithm of experiencing one roundabout after the other compensates by the universal distance of distributive pattern in pedestrian shortcuts. Not only this keeps the measured distances within average, but also increases the spatial integration of the roundabout structure in global variety of choice without social barriers.

Nevertheless, the network components of the pitteway graph differentiate the structured zones of roundabout Cairo from each other. On this specific level, the zone of 'Ezbekieh' resolves the interface of old and new Cairo through shortest distances of the dense pedestrian network for socioeconomic functions. The integral syntax, however, reverses the process to the minimum with less cyclic space for spatial filtration between regular and irregular meeting-up in Cairo. On the contrary, the opposite Tahrir zone eases the Eulerian network property through maximal cyclic spaces of increased layout integrity with spatial control due to its free open lands away from old Cairo. Meanwhile, the superimposed roundabouts in old Cairo measure the least integration with the farthest universal distances and cycle-free terminal edging. This structure satisfies the logic of different cognitive and social structure of the old town from the new colony, but sustains the city's vista of high Citadel topography with preserved visual dominance.

The overall synthesis of the roundabout network, however, determines the symbolic structure of 'Abdin Palace' to have the global power of most integrative space and the shortest universal connectivity. The unique structure exhibits the double face of Eulerian networking toward Tahrir and non-Eulerian on the opposite side of Ezbekieh, while reaching up the segregated roundabouts of old Cairo to become connected on the global level. The royal depth, nevertheless, is achieved through the planned subplazas that take the visitor through a shortcut from the roundabout to another spacious front plaza of the palace with the fenced interior. The same space connects in shortest distance to the other most integrative roundabout of the largest 'Hippodrome' public building where the European community socializes in extended symbolic structure.

On another front, the controversial connectivity of Abdin to the Ezbekieh zone observes another unique structure through the Ezbekieh garden itself. In addition to its less integral syntax of roundabouts, it forms a separating seam from old Cairo with a dense pedestrian network in the surroundings, while in the meantime allowing the concentration of major European socioeconomic activities on the garden side such as the Royal Opera landmark building. Therefore, Ezbekieh confronts old Cairo in contrasting spatial structure of unseen segregation through spatial measurements and seen integration of physical treatment. Despite the loss of some important elements such as the Opera and the Hippodrome, the still valid spatial structure of roundabout Cairo addresses the needed compensation of the lost landmarks, thus the essence of spatial and not only visual conservation as proved by this study. In brief, the correlative conclusion of restricted Ezbekieh and eased Tahrir with the symbolic Abdin integrity on the global level approaches the distinctive spatial structure of roundabout Cairo for future conservation, while justifying the adopted methodology for further experimental generalization on other spatial systems with extendable scope of graph network indicators.

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Laboratory Evaluation of Nanoparticles for Consolidation of Limestone in Archaeological Site of Jerash

Ruba Alomary, Mustafa Al-Naddaf, and Wassef Al Sekhaneh

Abstract

Limestones have been widely used in the construction of archaeological and heritage structures in Jordan. These stone structures are facing degradation due to many deterioration factors. Exposure to atmospheric conditions results in deterioration in historic monuments. Limestone conservation identifies emerging issues and challenges that have to be investigated in detail. In this study, limestone deterioration and the development of its consolidation treatments by synthesizing nano-sized particles of calcium hydroxide that dispersed in an alcoholic medium were investigated through an examination of limestone from the archaeological site of Jerash and another fresh limestone sample. Many properties were observed before and after the treatment, to examine the performance of nano-lime as a consolidant. All of the tests were conducted in laboratory conditions. When most of the conservation interventions relied on using organic materials, which were later proven to be harmful to stone on long term, a pressing demand is calling on representing new smart materials by using nano-lime for limestone consolidation; due to their improved mechanical properties, their physicochemical compatibility as consolidant materials follow the principle of authenticity of historic monuments (Wharton 1995). Results have shown that the application of nano-lime prepared in propanol-1 significantly improved the mechanical properties of the treated limestone. Compressive strength increased about 48% for archaeological and 38% for fresh samples, while the drilling increased by 500% for fresh and 84% for archaeological limestones; it has no significant change on porosity, although water uptake value (*w*-value) decreased 20%.

Keywords

Consolidation • Limestone • Calcium hydroxide • Nano-lime

1 Introduction

The history of humanity has been accompanied by the use of natural stones for buildings and monuments because of their availability, durability and aesthetic appearance (Siegesmund and Snethlage 2011). The situation was not different in Jordan, since natural stone is one of the most popular construction materials that have been used in since ancient times. It is used in building facades, concrete, foundations, floors and other architectural elements that form the building (Al-Share et al. 2012).

Samples for this study obtained from Jerash archaeological site (Gerasa) which is situated about 40 km north of Amman and about 30 km south of Irbid are shown in Fig. 1. Jerash (Gerasa) built to demonstrate luxury and power of the Roman empire as one of significant Decapolis cities, the city is well known historically and archaeologically for the presence of ancient Roman and Islamic settlements. Fresh limestone samples were obtained from the quarry. It is the conclusion of this paper/ that the quarryscapes of Gerasa (Jarash), Jordan. The quarry landscapes of Jarash offer an important opportunity to understand ancient Gerasa in its natural environment as well as its building materials. A number of quarry sites have been documented in the Jarash area as part of the quarryscapes project, including four major locations at Asfur, Al Shawahid, Wadi Suf, and Majar (Abu-Jaber et al. 2009). The quarries were used to extract building stone from the Upper Cretaceous Naur, Fuheis and Wadi As Sir Formations of the Ajloun Group." Limestone is durable, but it deteriorates when subjected to the exterior,

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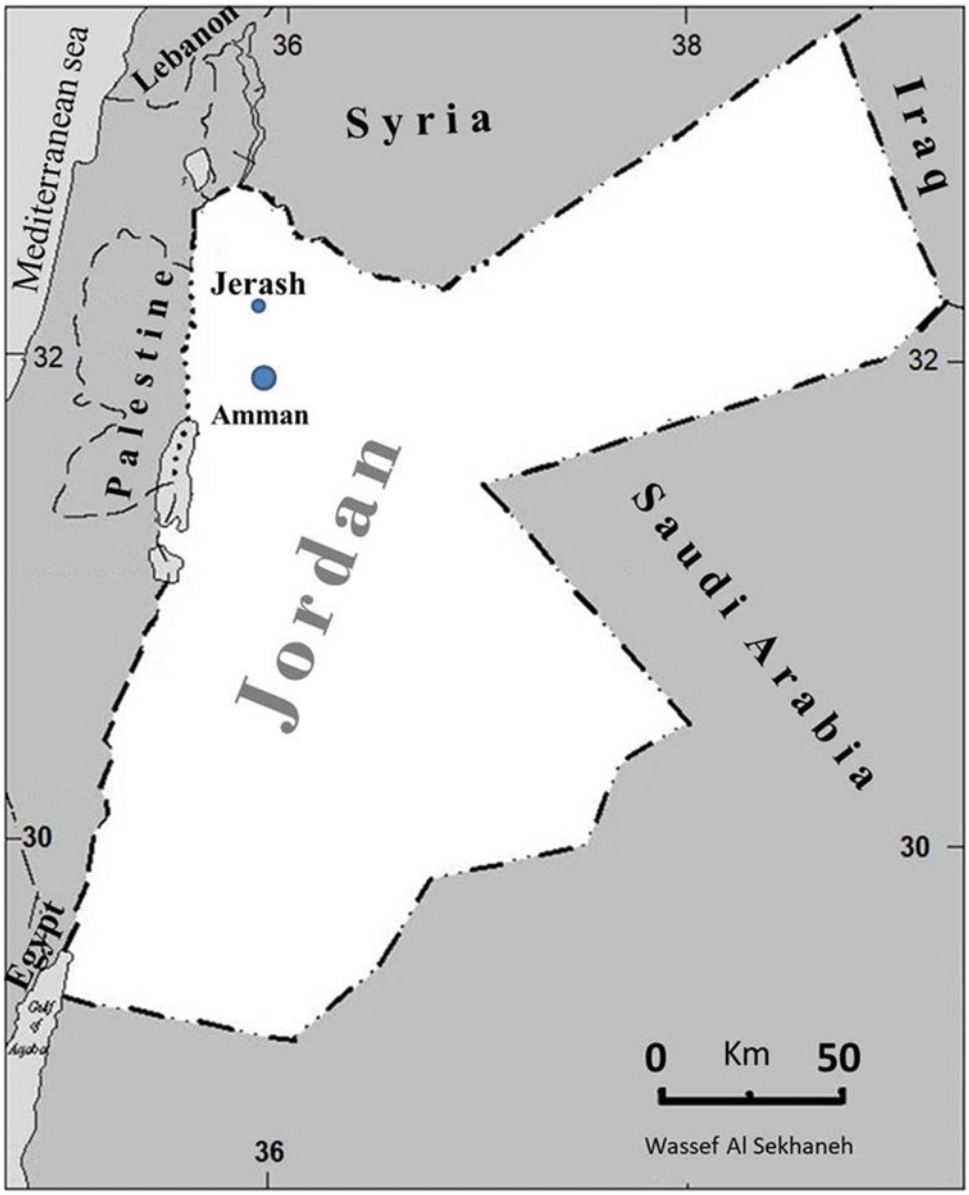
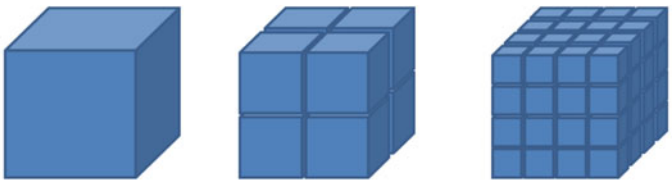


Fig. 1 Map of Jordan

natural and weathering exposures such as wind, rain and thermal changes. The mechanism of deterioration is caused by mechanical, physical, chemical and biological factors. Physical degradation has occurred due to an action of water, temperature variations and abrasion; physicochemical mechanisms involve the recrystallization cycles of soluble salts without associated chemical change. Chemical reactions are caused by pollutants in the atmosphere by absorbing water from surroundings; it will be highly reactive when exposing to acids or harmful gases, so it will suffer from substantial deterioration (Johnson et al. 1996). Microbiological activity causes direct physical damage to the surface and promotes chemical attack via waste product (Amoroso and Fassina 1983). The results of those weathering phenomena are visually observed in historic buildings in different forms like flaking and scaling of the surface layers, cracks on the surface and in the stone, powdering, material loss in stone in various forms such as outbursts, granular and fragmental disintegration (Smith and Přikryl 2007). The interaction between stone materials and weathering factors controls the type and extent of stone damages. Also insufficient maintenance, improper restoration techniques or adaptive reuse of monuments have contributed to the stone damage.

During the last few decades, interdisciplinary researches and new technologies have been introduced in monuments conservation (Fitzner and Heinrichs 2001). Conservation aims to control the decay mechanisms, attempts to mitigate the degradation of archaeological stones and improves the performance of decayed stone through its physical, physico



Edge length	4	2	1
Total surface area	96	192	384
Total volume	64	64	64
Surface-to-volume ratio	1.5	3	6

Fig. 2 Total surface area, volume and surface-to-volume ratio of a (model) cubic mass as it is divided into subunits. Surface-to-volume ratio increases, while total volume remains constant, by the author

mechanical and chemical properties and lasting its survival without altering its visual and aesthetic characteristics. There is a growing awareness of the principle of minimum intervention of the need to limit the use of materials that might be harmful either to the stone or to the environment (Price and Doehne 2011). Consolidation as a part of conservation can refer to some superficial parts of a stone, like making the surface of the stone water-repellent, or as another option, it may concern its bulk. Bulk consolidation is a very complex operation; the penetration of the consolidating material is challenge binding it together and connecting it with the sound stone beneath, penetration of the consolidating material has been studied in many publications over the last 20 years. Of course, the treatment will need to be reasonably cheap, easy to apply and safe to handle (Price and Doehne 2011; Baglioni and Giorgi 2006).

Both organic and inorganic consolidants have been used for conservation treatments (Rodriguez-Navarro et al. 2013). Inorganic-based consolidants have the great advantage rather than organic and synthetic consolidants, are of good durability, and from a physicochemical point of view, are usually highly compatible with limestone structure. The most common inorganic consolidants are solutions of limewater or barium hydroxide in water (Giorgi et al. 2000).

In principle, calcium hydroxide $Ca(OH)_2$ has been considered as the best compatible consolidant for carbonate-based stone like limestone because the maximum physicochemical compatibility can be achieved. When applying lime $Ca(OH)_2$ as consolidant, it strengthens powdering and flaking layers. Due to carbonation, $Ca(OH)_2$ turns into $CaCO_3$, providing a crystalline network that is coherent with the carbonate substrate, which mechanically reinforces the degraded limestone surface. However, calcium hydroxide efficacy is quite limited mainly due to many reasons: poor solubility of calcium hydroxide in water (1.7 g/L at 20 °C) which has mitigated an extensive use of lime in limestone consolidation (Hansen et al. 2003). In order to overcome this issue, lime dispersion in water is being used, but lime dispersions in water are not stable as they have a very fast sedimentation rate, which leads to the formation of a white film on consolidated surfaces (Daniele and Taglieri 2011). And Limited penetration depth of lime $Ca(OH)_2$ since its particle size is larger than most pores of limestone.

The nano-structures have opened new horizons for archaeological limestone consolidation, which represent a state of matter in between molecules and bulk structures, and are usually characterized by a large surface area that affects their physicochemical properties. Nano-structured materials (or simply nano-materials) have at least one dimension in the nanometre range, i.e. 10^{-9} m (Baglioni and Chelazzi 2013). Materials reduced to the nanoscale can suddenly show very different properties compared to what they exhibit on a macroscale: opaque substances become transparent (copper); stable materials turn combustible (aluminium); solids turn into liquids at room temperature (gold); insulators become conductors (silicon) (Kazemi et al. 2016). There is a significant impact on the reduction of cell size. As the size of the basic building blocks of a structure is reduced, the surface area per unit volume increases, as illustrated in Fig. 2. Scanning electron microscope (SEM) is a typical analytical device that allows us to visualize material morphology in the micro- to nanoscale (Doehne 2006).

The low solubility of calcium hydroxide in historic limewater was improved by using short-chain aliphatic alcohols such as ethanol, iso-propanol and n-propanol. Nano-lime consists of very small particles of calcium hydroxide suspended in alcohol; the average diameter is quoted as 150 nm with a range of 50–300 nm which is synthesized under specially controlled conditions. The smaller particle size of nano-lime has the advantages of

achieving greater penetration into the pores, minimum alteration of the water kinetics and pore's sizes. While the higher surface area/volume ratio allows greater reactivity (D'Armada and Hirst 2012). When a substrate is treated with nano-lime, calcium hydroxide is precipitated in the pores of calcareous materials as the alcohol evaporates. The overall carbonation process is represented by the following reaction:

$$Ca(OH)_2 + (H_2O + CO_2) \rightarrow CaCO_3 + 2H_2O$$

As calcium hydroxide carbonates to calcium carbonate, it replaces lost binder or matrix in natural limestone, fixing fine cracks and deteriorated stone, and increasing strength and integrity. The hydroxide particles penetrate within the substrate pores and recreate a network of crystalline $CaCO_3$ due to carbonation, bridging flaking parts. Therefore, the newly formed calcium carbonate is not merely a filler, but a true consolidant (Baglioni et al. 2014).

2 Experimental

For a better understanding of properties of the archaeological limestone from Jerash and a fresh limestone sample, the evaluation started with the determination of limestone properties related to consolidation such as tests defining the structure (e.g. porosity accessible to water (Nt), free porosity (N48) and capillary water uptake coefficient (*w*-value)) and mechanical strength (e.g. compressive strength, average drilling resistance and ultrasound). Consolidation means and methods were determined after reviewing the technical literature on nano-lime and other consolidants. The literature on the evaluation of nano-lime consolidants and RILEM guidelines tests defining the structure were reviewed to determine the shape and the size of limestone samples.

The application was conducted by immersing limestone samples into a nano-lime bath 10.5 g of nano-lime in 1.7 L of propanol-1. After immersion, the samples for 14 days in nano-lime solution were placed in the laboratory environment for 5 days for further carbonation process. The selected nano-lime consolidant used in this thesis was $Ca(OH)_2$ synthesized in chemistry laboratory at Yarmouk University. The objective of laboratory-based evaluation and analysis was to determine the properties and performance of limestone and to assess to what extent the nano-lime consolidant improved the surface and internal cohesion without altering critical properties. Following guidelines of the RILEM test (Commission 25-PEM: protection et érosion des monuments: recommendations provisoires: tentative recommendations, 1980), the nano-lime consolidant was evaluated based on its compatibility with the archaeological limestone.

2.1 Preparing Stone Samples

The laboratory experiments were carried out on two carbonate stones that were collected from two different locations. Stone samples are very pure calcitic limestone formed almost of dolomite $CaMg(CO_3)_2$. They have quite different porosities (Fig. 3) with low mechanical characteristics, a high open porosity and large pore sizes. These stone characteristics seemed to be suitable for such a consolidation study focused on the stone strength enhancement.

X-ray powder diffraction (XRD) is a rapid analytical technique primarily used for phase identification of a crystalline material. The analysed material is finely ground and homogenized, and average bulk composition is determined. Random X-ray diffraction pattern was conducted by Shimadzu Lab X 6000 X-Ray diffractometer under the following operating system; CuKα radiation, 1.5418 Å in the labs of Faculty of Archaeology and Anthropology Department of Heritage conservation. Obtain grams (or more) of the material, as pure as possible. Grind the sample to a fine

Fig. 3 Block of the archaeological sample as found in Jerash archaeological city

powder typically in a fluid to minimize inducing extra strain (surface energy) that can offset peak positions and to randomize orientation. Powderless than ~10 µm in size is preferred. Packing of fine powder into a sample holder then places it into a sample holder (Chipera and Bish 2002).

2.2 Synthesis of $Ca(OH)_2$ Particles

a. **First Method—Alcoholic**

As mentioned by (Ambrosi et al. 2001) in their article 'Colloidal particles of $Ca(OH)_2$: properties and applications to the restoration of frescoes'. Sodium hydroxide, NaOH, calcium chloride dihydrate, CaCl2â2H2O and propanol-1 (purity > 99.5%) were supplied by Merck, Darmstadt, Germany and were used without further purification.

NaOH solution (100 mL) (0.4M) and 100 mL of $CaCl_2$ solution (0.2 M) were separately heated to the selected temperature in the range 60–90 °C. When the selected temperature was reached, the two solutions were rapidly mixed under stirring, keeping the temperature of the mixture constantly within ±1 °C.

The $Ca(OH)_2$ suspension was allowed to gradually reach room temperature under a nitrogen atmosphere to avoid $Ca(OH)_2$ carbonation. The supernatant solution was discarded, and the remaining suspension was washed three times with water to reduce NaCl concentration. Each time, the dilution ratio between the concentrated suspension and washing solution was about 1:10. The complete removal of NaCl from the suspension was controlled by $AgNO_3$ tests.

b. **Second Method—Aqueous**

Calcium chloride ($CaCl_2$), sodium hydroxide (NaOH) and sodium bicarbonate ($NaHCO_3$) supplied by Merck were used without further purification (Daniele et al. 2008). To obtain about 20 g of $Ca(OH)_2$ nanoparticles, two different aqueous solutions of 900 ml, containing 0.3 mol/L of $CaCl_2$ and 0.6 mol/L of NaOH, respectively, were prepared. The NaOH alkaline solution (used as precipitator) was added drop-wise into the $CaCl_2$ solution (speed 4 mL/min, a temperature of 90 °C). After about 24 h, two distinct phases were observed: a limpid supernatant solution and a white precipitated phase. In order to remove the produced NaCl, several deionized water washings were performed to obtain aqueous nano-lime suspension (with concentration of 15 mg/mL).

3 Results and Discussion

3.1 X-Ray Diffraction (XRD)

The XRD identified calcite $CaCO_3$ as major mineral and dolomite as traces for the archaeological limestone before and after treatment with nano-lime which are almost the same as shown in Fig. 4. This emphasizes the fact of compatibility of nano-lime as consolidant.

3.2 Morphological and Structural Analysis

Using tools that allow investigation at the nanoscale level was essential in this thesis, as nano-lime consolidant is composed of nanoscale particles. SEM micrographs,

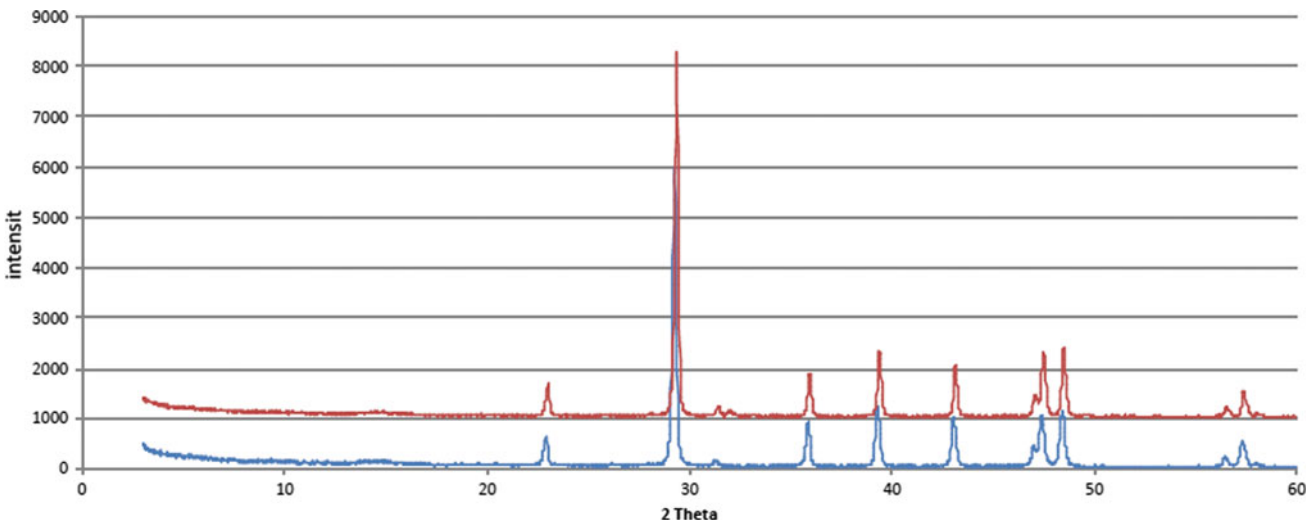


Fig. 4 X-ray diffractograms of archaeological limestone samples: sample before treatment (bottom) and sample after above. The main peak refers to calcite

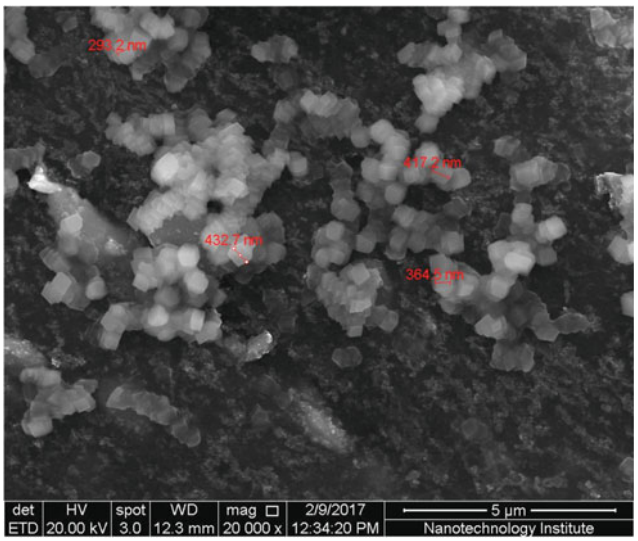


Fig. 5 SEM micrograph of the alcoholic nano-lime suspension

obtained on an alcoholic sample, are reported. Figure 5 shows a typical $CA(OH)_2$ nanoparticles agglomerate, where the particles are crystalline and regularly shaped, range from 200 to 450 nm. Regarding particles crystallinity, these particles reveal typically crystalline features.

The following SEM images for aqueous method show how much agglomeration produced, this could be a huge obstacle for limestone consolidation; due to Limited penetration depth Fig. 6a, b.

4 Particle Size Distribution Data and Zeta Potential

The significance of zeta potential is that its value can be related to the short- and long-term stability of emulsions. Emulsions with high zeta potential (negative or positive) are electrically stabilized, while emulsions with low zeta

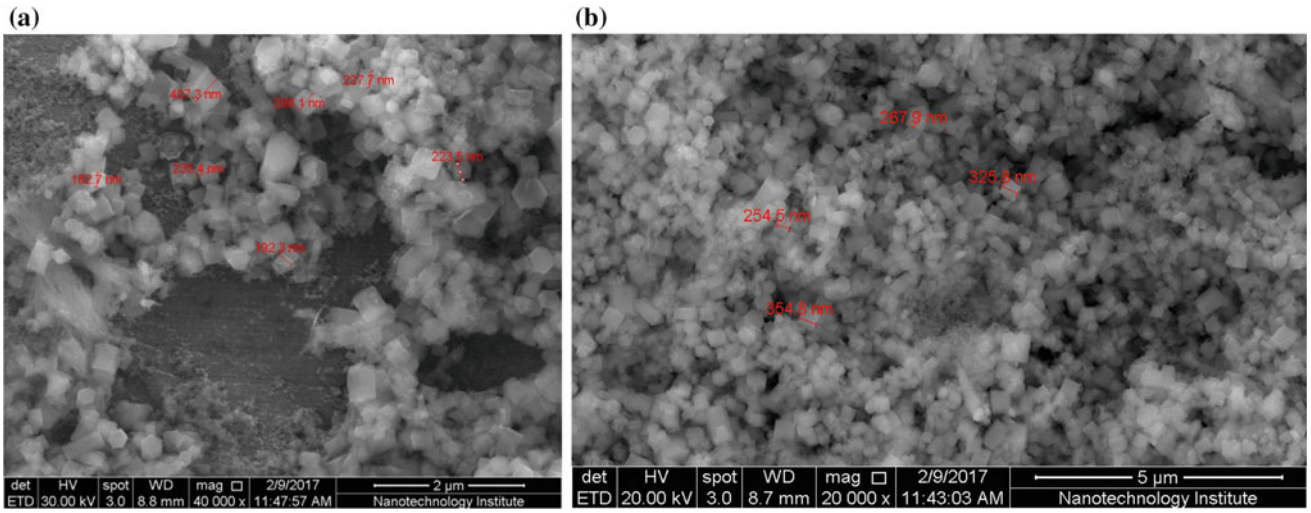


Fig. 6 **a, b** SEM micrograph of the aqueous nano-lime suspension

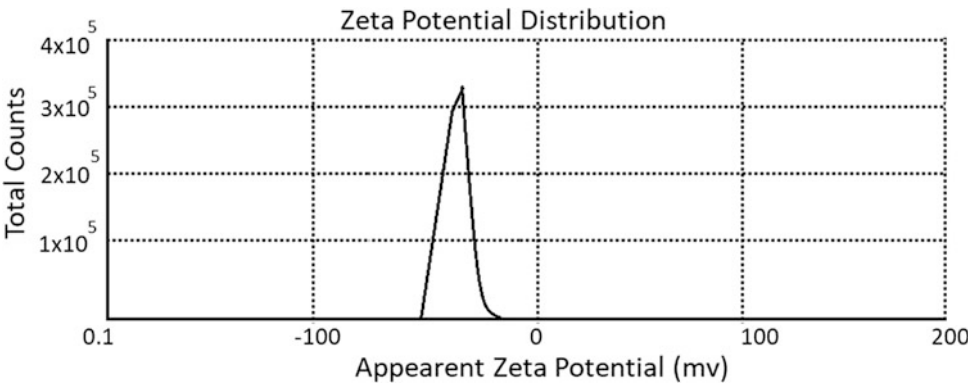


Fig. 7 Surface zeta potential graph for aqueous nano-lime sample, produced by the author showing negative zeta potential value for nano-lime particles. Zeta potential (mV): −34.1, zeta deviation (mV): 4.32 and peak 1: −34.1

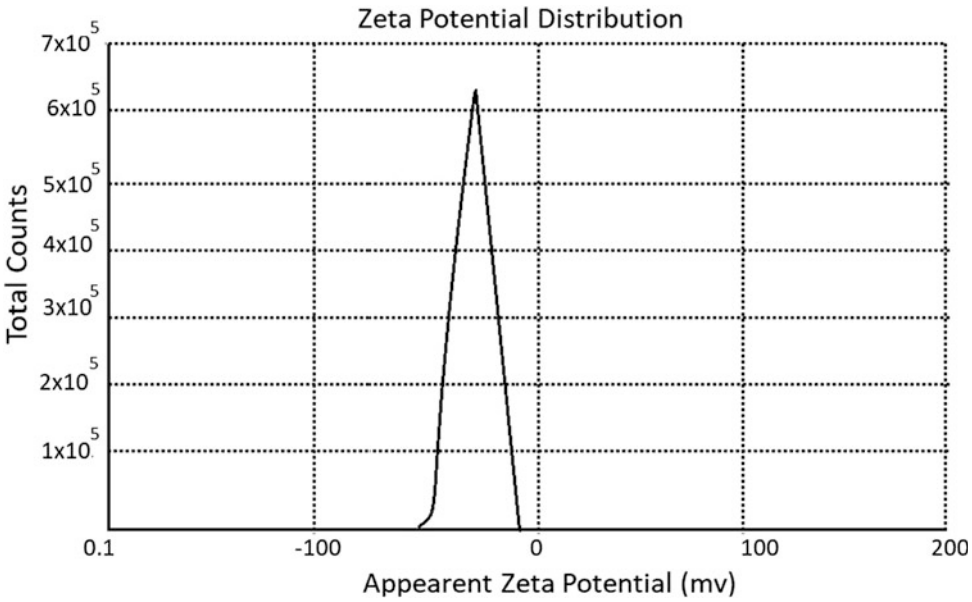


Fig. 8 Surface zeta potential graph for alcoholic nano-lime sample, produced by the author showing negative zeta potential value for nano-lime particles. Zeta potential (mV): −15.6, zeta deviation (mV): 3.46 and peak 1: −15.6

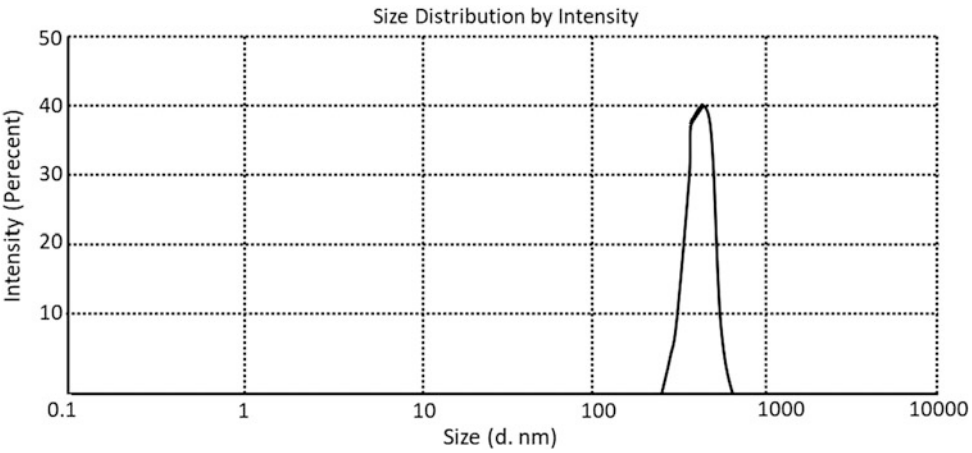


Fig. 9 Nano-lime in propanol-1 particle size distribution data reported by intensity, using Malvern Instruments produced by author. *Z*-Average (d nm): 1016, Peak 1: size 434.3 (d nm) and standard deviation: 52.34 (d nm)

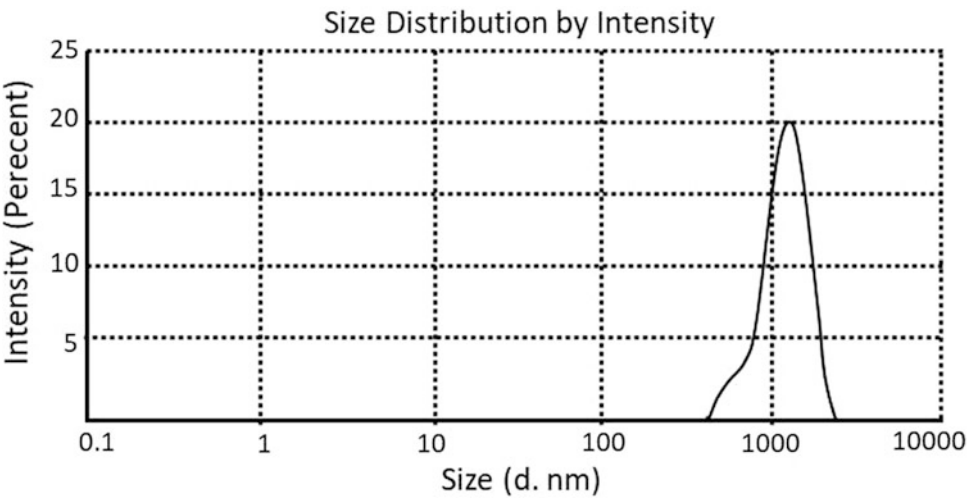


Fig. 10 Nano-lime in water, particle size distribution data reported by intensity, using Malvern Instruments produced by author. *Z*-Average (d nm): 2120, Peak 1: size 1203 (d nm) and standard deviation: 347.4 (d nm)

potentials tend to coagulate, possibly leading to poor physical stability (Bhattacharjee 2016).

It has been shown that short-chain alcohols are highly effective in increasing the colloidal stability of Ca $(OH)_2$ nanoparticles, which otherwise aggregate and settle rapidly when dispersed in water. Electrokinetic measurements show that $Ca(OH)_2$ particles dispersed in water have a zeta potential of −34.1 mV Fig. 7, while in propanol-1, the zeta potential drops to −15.6 mV Fig. 8. The low dielectric constant of alcohol results in very small Debye lengths and reduced screening, if compared with water. This means that particles dispersed in propanol-1 will tend to aggregate due to attractive van der Waals forces. However, this is not what our experimental results show. Electrostatic interactions do not, thus, account for the increased kinetic stability of Ca $(OH)_2$ dispersions in short-chain alcohols (Rodriguez-Navarro et al. 2013) (Figs. 9 and 10).

4.1 Results for Nt and N48

Nano-lime consolidation appears to have little to no impact on the pore structure of the limestone samples as shown in Fig. 11. The porosity value of the untreated and consolidated samples was almost identical, 2% change in total porosity. As shown in Fig. 8, which compares the volume of porosity accessible to water (Nt) for the two samples before and after consolidation. No obvious change in pore structure was observed from the test. This implied that the result was statistically not significant at 95% confidence level, and the change in the pore system was negligible.

For archaeological limestone samples, w-value is 9.6 kg/m^2/$\sqrt{h}$ before treatment and 7.72 kg/m^2/$\sqrt{h}$ after treatment Fig. 12. For fresh limestone samples, *w*-value is 2.45 kg/m^2/$\sqrt{h}$ before treatment and 1.77 kg/m^2/$\sqrt{h}$ after treatment Fig. 13. Experiments' calculations reveal that nano-lime has more impact on fresh stone w-value with 27% reduction; for the archaeological samples, the reduction ratio is 19%.

Consolidant uptake value (*c*-value) for alcoholic nano-lime in archaeological sample = 5.14 kg/ m^2/$\sqrt{h}$. *c*-value for alcoholic nano-lime in fresh sample = 1.1 kg/m^2/$\sqrt{h}$. This is due to the presence of nanoparticles suspended in alcohol which causes the increase of the surface tension of alcohol. Consequently, the attraction force between the nano-lime solution and the surface of the pores will decrease and the c-value will also decrease.

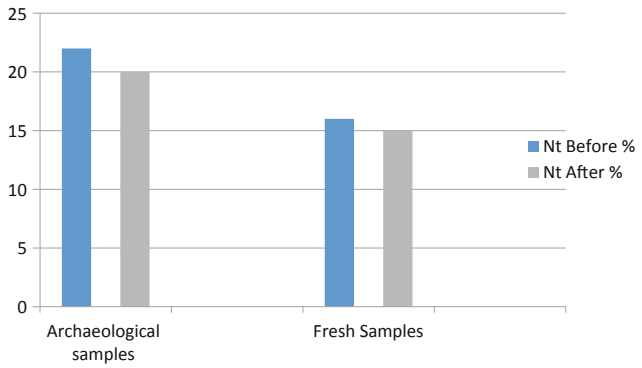


Fig. 11 Comparison of open pores percentage—archaeological and fresh samples

4.2 Compressive Strength Results

Nano-lime consolidation resulted in the increased compressive strength of treated limestone samples. The average compressive strength of untreated and consolidated is provided in Table 1 that compares the mean value of the compressive strength for the untreated samples and consolidated samples. One application of nano-lime showed approximately 37% for fresh stone and 48% for the archaeological increase in compressive strength after a minimum of 14 days of curing of the nano-lime consolidant. This was conducted with a compressive strength machine (EleAutotest).

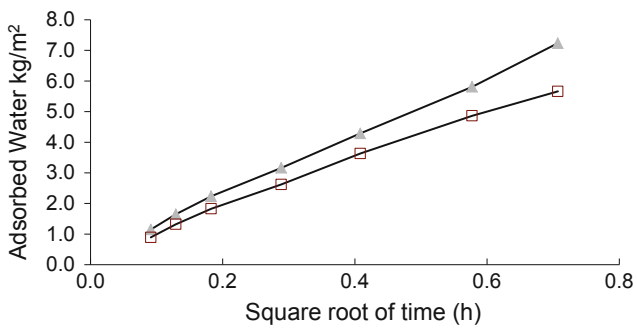


Fig. 12 Capillary water absorption curves before (triangle) and after (square) consolidation for archaeological samples

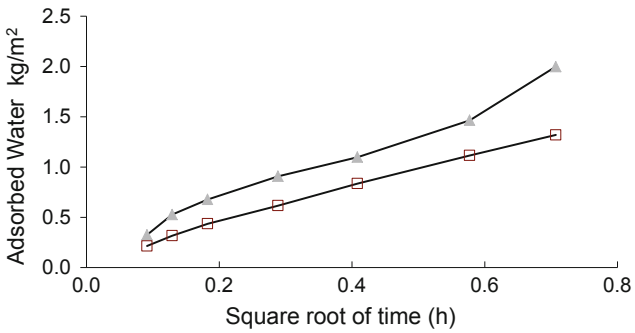


Fig. 13 Capillary water absorption curves before (triangle) and after (square) consolidation for fresh limestone samples

Table 1 Summarized compressive strength results and statistical confirmation

Parameters	Before treatment		After treatment		% increase	% increase
	Fresh sample	Archaeological sample	Fresh sample	Archaeological sample	Fresh sample (%)	Archaeological sample (%)
Maximum load (kN)	88.3	31.16	120.6	46.4	37	48
Compressive strength (N/mm^2)	35.34	12.47	48.24	18.56		

Table 2 Summarized drilling resistance results and statistical confirmation

Parameter	Before treatment		After treatment		% increase	% increase
	Fresh sample	Archaeological sample	Fresh sample	Archaeological sample	Fresh sample (%)	Archaeological sample (%)
Average drilling resistance (N)	8.771	16.556	53.62	30.51	500	84

Table 3 Summarized ultrasonic velocity results and statistical confirmation

Samples	Before treatment		After treatment		
	Vp (m/s)		Vp (m/s)		% increase
	Perpendicular to bedding	Parallel bedding	Perpendicular to bedding	Parallel bedding	
Fresh sample	2825	3383	3200	3250	4
	Average = 3104		Average = 3225		
Archaeological sample	2225	2415	2300	2867	11
	Average = 2320		Average = 2584		

4.3 Average Drilling Resistance Results

For this experiment, using a Drilling Resistance Measurement System (DRMS), which measures the drilling resistance of stone materials and mortars, 5–7 readings were taken for five samples; the archaeological samples show a heterogeneous distribution of consolidant (Table 2).

4.4 Ultrasound Velocity Results

By using PUNDIT Ultrasonic Pulse Velocity (UPV) instruments, the average of ultrasound velocity increased for the archaeological samples 11% and for the fresh samples 4% (Table 3).

5 Conclusions

In this study, nano-dispersive calcium hydroxide solutions in propanol-1 alcohol with improved concentrations were successfully prepared. This thesis demonstrated that archaeological limestone can be strengthened by consolidation with propanol-based nano-lime at low concentrations without displaying significant physicochemical changes. As given in Table 4, the results of all testing conducted in this thesis are summarized and provided with the statistical confirmation.

The results were obtained after 15 days of nano-lime application:

- It is recommended to expand application time for better-improved properties.
- The archaeological block was heterogeneous; few results were discarded.
- The decision as to whether a nano-lime consolidant should be used on historic limestone is dependent on conditions and measurable property changes.
- Environmental conditions will greatly affect the cure of nano-lime, and in situ testing must be performed to confirm laboratory test results.
- The results of the investigations are used to suggest building conservation solutions for this particular site.
- They also provide recommendations for future conservation options for archaeological limestone monuments and structure in Jordan.

Table 4 Summary

Testing parameters	Results	Statistical confirmation
Porosity (porosity accessible to water and free porosity)	Nano-lime consolidation has little to no impact on the pore structure of the limestone samples. Less than 2% reduction in porosity	Not significant
Capillary water uptake (*w*-value)	Experiments' calculations reveal that nano-lime has more impact on fresh stone w-value with 27% reduction; for the archaeological samples, the reduction ratio is 19%	Not significant
Compressive strength	Increasing the compressive strength of treated limestone samples. One application of nano-lime showed approximately 37% for fresh stone and 48% for archaeological samples	Significant
Drilling resistance	Increased drilling resistance, approximately 500% for fresh stone and 84% for archaeological	Significant
Non-destructive ultrasonic method	Fresh samples have shown little increase in velocity after treatment only 4%, where as the increase is 11% for the archaeological samples	Not significant

5.1 Recommendations for Future Research

Like many other lime-based building materials, the performance of the nano-lime consolidant is associated with the completion of the carbonation process, which may continue for many years. Therefore, to understand a long-term performance of nano-lime consolidant on limestone, further testing is required on the additional sample sets created for this research. This will allow performance evaluation of the nano-lime consolidant after longer curing (carbonation) period. The long-term durability of nano-lime has to be further studied by dilatation measurements and cyclic durability tests, along with micro-structural analyses similar to the ones performed in this study. Further research is needed for finding the appropriate application technique either in site or laboratory, like brushing, poultice or immersion. The role of the application technique is essential on the performance of consolidated limestone as this case.

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Adapting Geographies of Gentrification in Egypt: Lesson Learned from Fatimid Cairo and Heliopolis

Muhammad Eldaidamony, Ahmed A. A. Shetawy, Yehya Serag, and Abeer Elshater

Abstract

Since the 1960s, gentrification has been confused with other urban notions such as upgrading and renewal, regardless of its economic and political perspectives, whereas it has been processing and evolving in urban neighborhoods, especially in the Western countries such as the USA and the UK, away from the developing countries. It took place also in other countries outside the core cities of gentrification. Researchers and urban planners agreed that to re-energize the study of gentrification is to focus on its 'geographies' which are super-gentrification, third-world immigration—the global city, black/ethnic minority gentrification—race and gentrification, and livability/urban policy. To this point, the cultural diversity was omitted from the geography of gentrification, something that this paper will try to elaborate on and identify. Due to sociocultural differences between gentrification taking place in the developed world and that happening in the developing countries, the research suggests adding two new categories to the geographies of gentrification to reflect the specificities of Egypt. For instance, gentrification in Egypt is driven by other geographies of gentrification, namely historical-tourism gentrification and contracting/real estate gentrification. Thus, monitoring, observation, and analyzing of Heliopolis and Fatimid Cairo will be used to achieve the paper's main objective; to adapt the gentrification process with the Egyptian case studies, and to fill the gap in the gentrification literature regarding the geographies of gentrification in developing countries, the theme that will establish a new level of gentrification and open new field of research in Egypt. Therefore, urban planning will have a different valid scope in Egypt and provide decision makers with a new tool to develop and maintain the urban planning approaches in Egypt.

Keywords

Fatimid Cairo • Gentrification • Geographies of gentrification • Heliopolis • Historical Cairo

1 Introduction

After fifty years of gentrification worldwide, there now exists a substantial body of literature, books, research, papers, and more written and applied materials for this topic. The material of gentrification varies from the theoretical to a kind of applied study. As the main issue with richness, the gentrification literature is the different case studies away from the so-called core cities, London and New York. Case studies have different spatial locations, economic, social, and cultural environments, also to fill in the gap in the literature regarding the geographies of gentrification in Egypt. However, what Ward (1993) mentioned, regarding the biases of some geographers as UK–US ethnocentrism, is that 'too many Anglo–American geographers remain ignorant about processes operating outside of their own immediate cultural context' (1993: 1133). Thus, this research will try to differentiate between the different notions and urban models, revitalization, upgrading, regeneration, renewal, and gentrification. It would also explore the economic, political, cultural, and social perspectives of gentrification, which would widen the scope to cover gentrification aspects in Egypt. So far, the research will help you understand the current geographies of gentrification and open the field for two new geographies which will be introduced by the research for two main aims, first, to fill in the gap in the literature regarding gentrification in developing countries, and second, to cover the social and cultural differences between developed and developing countries' gentrification. Meanwhile, the gentrification process in Fatimid Cairo and Heliopolis is

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a way to fulfill the residents' requirements and demands, residents who are benefiting from the concentric spatial location close to job centers and urban facilities. This will work as part of the back to the city movement that was defined by Neil Smith in 1979.

2 Concepts in Urban Development

1. Gentrification is usually mixed with other urban models (Dalla Longa 2011) such as upgrading, renewal, revitalization. This mix is based on the spatial and social perspectives and differences that each author argues. Here, the researcher will try to differentiate between the main urban models to identify the main path of the research, and not to mix gentrification with other urban models, which sometimes may be misleading and cause confusion with the gentrification process.
2. Upgrading, or sometimes called as slum improvement, as mentioned on the Massachusetts Institute of Technology webpage, is basically an urban project for *'slum improvement in low-income urban communities has many things, but at its simplest it has come to mean a package of basic services: clean water supply and adequate sewage disposal to improve the well-being of the community. But fundamental is legalizing and "regularizing" the properties in situations of insecure or unclear tenure*.' Here, urban upgrading provides a package of improvements in streets, footpaths, and drainage, also solid waste collection, along with streetlights for security and night activity, electricity to homes, providing clinics and health education programs, school facilities, and teacher training and lastly programs are offered to increase income-earning opportunities and the general economic health of a community. Urban upgrading is broadly defined as physical, social, economic, organizational, and environmental improvements undertaken cooperatively among citizens, community groups, businesses, and local authorities to ensure sustained improvements in the quality of lives for individuals. Meanwhile, gentrification is basically starting within a neighborhood which already has the main facilities, but it works on improving those facilities. Gentrification comes first with economic factors while upgrading takes economic factors lately.

Richards (2014) referred to urban renewal as '*a set of plans and activities to upgrade neighborhoods and suburbs that are in a state of distress or decay.'* Thus, urban renewal programs address the physical aspects of urban decay. Urban problems such as deteriorating housing, poor physical infrastructure (including water and sanitation services), and poor community services such as sports and recreational amenities are addressed through such programs. Moreover, urban renewal can be distinguished from urban regeneration, as urban regeneration is a wider-ranging, more holistic policy intervention that incorporates physical, social, and environmental regeneration. Urban renewal was considered as an alternative to the unpopular policy of 'slum clearance' involving demolishing decaying housing and slum areas and relocating the people living there to other parts of a city. While urban renewal has negative consequences of social segregation and social equity, gentrification's main negative consequence is displacement. Moreover, Neil Smith (2010) argued that urban renewal, like rehabilitation, occurs where a rent gap has been opened, but in the case of renewal either the dilapidated stock is unsound structurally or the remaining structures are unsuitable for new uses.

According to the IGI Global Dictionary, urban revitalization is a process by which a part of the city in social, urban or economic crisis undergoes a deep transformation, to reverse the declining trend, while gentrification has worked its way into the planning manifestos of urban policy agendas to improve the economic, physical, and social outlook of disinvested central-city locations around the world. Often disguised as 'regeneration,' 'renaissance,' 'revitalization,' or 'renewal,' gentrification has become, in the words of one renowned gentrification scholar, 'a global urban strategy' and 'the consummate expression of an emerging neo-liberal urbanism'. Thus, it is hard to be against revitalization, regeneration, or renaissance, but much easier to be against gentrification.

Dalla Longa (2011) argued in her chapter of Urban Models, the different notions of urban development projects, and mentioned that the struggle over words might seem obscure or tedious, stranding us *'on the desert island of terminological debate'*. Moreover, this terminological struggle blurred into the second set of more conceptual disputes. 'Gentrification' is still understood as a term of class conflict that raises questions of equity and fairness, and so it is crucial that we challenge the political campaigns of those who are trying to displace the term in favor of soft euphemisms (regeneration, revitalization, renaissance, re-urbanization, residentialization, etc.) and those such as Andres Duany (2001) trying to redefine the term as a badge of honor for gentrifiers. One of the lessons of the sociology of knowledge is that words are not passive; indeed, they help to shape and create our perceptions of the world around us.

3 Literature Review

3.1 Gentrification Perspectives, Cultural, Economic, Political, and Social

Since the process of gentrification started to flourish and gain more attention, the literature about it started to boom as well. Most of this literature concerns the contemporary processes or their effects: the socioeconomic and cultural characteristics of immigrants, displacement, the role in redevelopment, benefits to the city, and the creation and destruction of community. Little attempt has been made to construct historical explanations of the process, to study causes rather than effects. Instead, explanations are very much taken for granted and fall into two categories: cultural and economic.

Culturally, popular among revitalization theorists is the notion that young, usually professional, middle-class people have changed their lifestyle, those youngsters are the main engine for the gentrification process. As according to Gregory Lipton, these changes have been significant enough to 'decrease the relative desirability of single-family, suburban homes' (1977, p. 146). Thus, with a trend toward fewer children, postponed marriages, and a fast-rising divorce rate, younger homebuyers and renters are trading in the tarnished dream of their parents for a new dream defined in urban rather than suburban terms. Other researchers emphasize the search for socially distinctive communities as sympathetic environments for individual self-expression, while still others extend this into a more general argument. In contemporary 'post-industrial cities,' according to D. Ley, white-collar service occupations supersede blue-collar productive occupations, and this brings with it an emphasis on consumption and amenity, not work.

Economically, as the cost of newly constructed housing continues to rise and its distance from the city center to increase, the rehabilitation and re-urbanization of inner- and central-city structures are seen to be more viable economically, and additionally, with some governmental policies to fill in the leftover vacant lands with new mixed-use buildings to fulfill the high demand on urban facilities. Old but structurally sound properties can be purchased and rehabilitated for less than the cost of comparable new houses, especially in historic and high-density neighborhoods where land value is relatively high. In addition, many researchers stress the high economic cost of commuting and the economic benefits of proximity to work, by which bad transportation networks increase the demand on concentric housing locations. According to the neoclassical theory, suburbanization reflects the preference for space and the increased ability to pay for it due to the reduction of transportation and other constraints. Similarly, gentrification is explained as the result of an alteration of preferences and/or a change in the constraints determining which preferences will or can be implemented. Thus, in the media and the research literature alike, the process is viewed as a 'back to the city movement.' This applies as much to the earlier gentrification projects, such as Philadelphia's Society Hill. Furthermore, the relationship between political economy and gentrification challenges the dominant inclination among academics to attend narrowly to debates surrounding this relationship. Specifically, how elites' interests are prioritized over and above those with less economic or political capital, and how this inequality is reproduced in and marks urban lives and landscapes. It attends to the role of coalitions of elites (Logan and Molotch 1987) with the broad economic and political shifts that help gentrification at the cost of attention to numerous other facets.

3.2 The Economic, Social, and Cultural Difference Between Gentrification in Egypt, UK, and USA

3. Socially, the University of Chicago Policy Analyst Betancur (2002), who, in a study of gentrification in West Town, Chicago, argues that gentrification is really a struggle between community and accumulation. Gentrification has a face—a set of forces manipulating factors such as class and race to determine a market outcome. The most traumatic aspect is the destruction of the elaborate and complex community fabric that is crucial for low-income, immigrant, and minority communities without any compensation. For Betancur (2002), gentrification is not about social mix, emancipation, creativity, and tolerance; it is about arson, abandonment, displacement, 'speculation and abuse', ethnic minority tenant hardships, and class conflict. For instance, when we discuss how we should define the 'gentrifier,' we are not just debating the role and characteristics of a set of actors involved in gentrification, but also what we mean when we refer to someone as 'middle class' and how to understand the relationship between traits such as race, income, gender, and ideology and behavior. One negative effect, the displacement of the working-class and/or ethnic minorities, was (and still is) of serious concern, as Powell and Spencer (2003) figured in Chicago.
4. Economically, there is a difference between the gentrification in the core countries and Egypt, for instance, the gross domestic product (GDP) (PPP) per capita of each country. According to the World Bank, from 1990 to 2016 based on actual data, the GDP of Egypt, UK, and

USA increased from 3819 USD to 11,150 USD, from 16,739 USD to 43,081, and from 23,955 USD to 57,638 USD, respectively. The theme reflects the economic differences for each country; thus, the income per capita and social class levels also differ. So, the economic status of the residents is different when identifying the middle classes in each country. Ramzy (1997, 1993) defined the middle class as the class which gains wages from working in governmental jobs, public sector, and private freelance jobs; he also categorized the middle class to three different categories, high, middle, and low. Ramzy also mentioned that there is a big difference between the high and low classes regarding income, consumption, savings, working rehabilitation, education, and class awareness.

5. However, according to Central Agency for Public Mobilization and Statistics (CAPMAS) in 2015, the Egyptian poverty line stands at an income of LE 5787.9 (327 USD) annually and LE 482 (27 USD) monthly, thus around 27.8% of the Egyptian population is under the poverty line, while in the USA according to the Census Bureau in 2013, the annual income threshold for being counted as living in poverty was 11,490 USD for a person, and monthly 957.5 USD, thus around 15% of the American population is under the poverty line. Almost a 33% of the UK population fell below the official poverty line at some point between 2010 and 2013, with 14, 758 GBP (19,720 USD) annually and 1230 GBP (1644 USD) monthly. Besides, each country has its own architecture, urban planning practices and urban environment that was accumulated through centuries, with social, cultural, and economic mixture, starting from historical ancient Egyptian, Islamic, and modern architecture. So far, the main gentrifiers in Egypt are the young families, mainly with high education level, with one or two children, who are the main engine for the gentrification process due to their need to find comfortable housing, while in USA and UK, it is the young professionals, gays, and students, which were referred to, by Butler 1997, as the new middle class and, by Richard Florida 2003, as the creative class. Additionally, the culture of mobility and commuting varies from being attached to your home and family, as a study which was done in 1996 proved that the average age of leaving the family in Egypt was 33 years of age while in the UK was 24 years of age.

3.3 Geographies of Gentrification

Lees (2000) believes that the way to re-energize the study of gentrification is to focus on what Ley (1996) has called the 'geography of gentrification.' The 'geography of gentrification' emerges as the common denominator for both the recent changes in the gentrification process and the holes in the gentrification literature. Thus, she identified four which research into the 'geography of gentrification' needs to address: (1) financifiers—super-gentrifiers; (2) third-world immigration—the global city; (3) black/ethnic minority gentrification—race and gentrification; and (4) livability/urban policy—discourse on gentrification.

In addressing the issue of *financifiers*, gentrification researchers must return, as Bondi (1999a) did, albeit inadvertently, to a consideration of temporality. Wyly and Hammel (1999) have also found that capital flows are being redirected and focused on a few highly desirable neighborhoods. The whole concept of urban community is in transition, the financifiers' ties to the community, to the neighborhood, are much weaker than those of the gentrifiers of old. The financifier has a much less deeply rooted relationship with his or her neighborhood—as with the highly mobile capital they work with, these super-gentrifiers are more mobile too—their identity is arguably more fluid than rooted. As in the case of third-world immigrants, *black and ethnic minority gentrification* has scarcely been researched either (see Smith 1996, for research into black gentrification). Black gay gentrifiers in the Castro District of San Francisco in the 1970s came up against racism. This distorts the image of gentrification as liberal tolerance. It also points to the complex intricacies within social cleavages—black, gay and middle class, and white gay racist gentrifier. Blacks as seen in Smith's (1996), 'revanchist city thesis,' are often portrayed as the 'victims' of the gentrification process. But blacks can also be the 'agents' of gentrification.

Nevertheless, deconstructing discourse on gentrification is important and it is nowhere more so than when considering recent urban policy statements/initiatives by governments in both the UK and the USA. For example, the British Urban Task Force's report *Towards an urban renaissance* (DETR, 1999) and the US Department of Housing and Urban Development's *The state of the cities* report (1999) both interweave urban regeneration policy with gentrification practices and environmentalism. Gentrification in the guise of urban livability/sustainability is constructed as the medicine for the problems endured by British and American cities. The 'geography of gentrification' works on many different levels—international comparison, intranational, and citywide comparison. Moreover, in the literature on gentrification we can see that even within single city gentrification of a similar time period has a quite different geography depending on its site. It would also enable us to consider the merits or dangers of cities further down the urban hierarchy taking on board the gentrification practices of cities higher up the urban hierarchy, cities with a very different geography.

4 New Geographies of Gentrification in Egypt

One of the objectives of the study is to explore the new geographies of gentrification, proposed by the research, related to the case study in Egypt. These new geographies will be explained in the next few sentences to clarify the idea and to fulfill the literature gap regarding the case studies in Egypt.

4.1 Historical-Tourism Gentrification

Meanwhile, in a previous study in 2015, the gentrification process was driven by cultural tourism and commercial activities in historic Fatimid Cairo, and cultural tourism development was the potential for gentrification to take place. As the gentrification spots started to be active, the buffered building around it started to change dynamically, by which the neighboring building owners seek to benefit as well from the development around them. Gotham (2005) referred to tourism gentrification as the transformation of a middle-class neighborhood into a relatively affluent and exclusive enclave marked by a proliferation of corporate entertainment and tourism venues. Historically, the Vieux Carre, New Orleans, USA, has been the home of diverse groups of people. Over the past two decades, however, median incomes and property values have increased, escalating rents have pushed out lower-income people and African Americans, and tourist attractions and large entertainment clubs now dominate much of the neighborhood. It is argued that the changing flows of capital into the real estate market combined with the growth of tourism enhance the significance of consumption-oriented activities in residential space and encourage gentrification. So far, gentrification is an expression of consumer demands, individual preferences, or market laws of supply and demand. It examines how the growth of securitization, changes in consumption and increasing dominance of large entertainment firms manifest through the development of a tourism industry, giving gentrification its own distinct dynamic and local quality, this can happen not only in New Orleans but also in the case studies in Cairo as well. As local elites use tourism as a strategy of economic revitalization, tourism services and facilities are incorporated into redevelopment zones and gentrifying areas. In this new urban landscape, gentrification and tourism amalgamate with other consumption-oriented activities such as shopping, restaurants, cultural facilities, and entertainment venues. That blurring of entertainment, commercial activity, and residential space leads to an altered relationship between culture and economics in the production and consumption of urban space. As contemporary cities increasingly turn to tourism as a means of economic development, and as gentrification expands in many cities, we need more critical accounts of the nexus of tourism and gentrification. Indeed, tourism study can contribute much to ongoing debates of urban ethnic transformation, globalization, and gentrification.

4.2 Real Estate/Contracting Gentrification

Real estate activity is an essential sector worldwide and especially in Egypt. Housing supply was mostly by the private sector until the late 1950s, when rent control laws were applied. A sizeable proportion of developers in the housing market, as a result, shifted their investment to other fields. After that, the public sector assumed a major role in housing supply through central and local governments, development agencies, and public housing companies. The semi-public agencies helped in the production of housing units—new-built housing units—through housing cooperatives, Al Awqaf Egyptian Authority, banks, insurance companies, and the construction of housing for individual workers. The private sector diminished to a few individual landlords, owner-occupiers, and small development companies. Provision of infrastructure remained the responsibility of the government. The total number of housing units built per year by both public and private sectors decreased from 56,000 units in the 1950s to fewer than 30,000 in the 1960s. The change in economic policy in the second half of the 1970s caused drastic changes in the housing market. The annual number of units built increased steadily to reach more than 180,000 in 1990. The role of the public sector diminished and was limited to the provision of low- and medium-cost units, mainly in the new towns and settlements around the Greater Cairo Region. Private investment in the housing and real estate sectors has increased continuously in the past two decades, even though these sectors are, in theory, tightly regulated and rent controlled and suffered from credit shortages. According to the estimates by the Ministry of Housing and Reconstruction, private sector gross investment in housing grew from LE 732 million in 1982/83 to LE 2950 million in 1991/92, representing more than 25% of the total private investment in Egypt. On the other hand, public gross investment in housing fluctuated from LE 67 million in 1982/83 to LE 370 million in 1986/87 and back to LE 91 million in 1991/92, representing less than 1% of total Egyptian public investment.

Similarly, gross value added in the private housing sector rose from LE 350 million in 1982/83 to LE 2,223 million in 1991/92, whereas it increased only from LE 62 million to LE 127 million in public housing sector over the same period. In 1991/92, the private sector represented 97% of the total

investment in housing and 95% of the total value added in the housing sector. Investment of the private sector in housing included the high demand resulting from urban population growth. In addition, private sector developers find ways around the rent control laws, such as build-to-own arrangements, and cash advances paid to developers. The illegal/informal housing that represents a large portion of the Egyptian housing market is totally financed by private investment. Given the limited choice of alternative investments in the Egyptian market (especially during the periods of recession), real estate is a major outlet for domestic savings, especially for the remittances of Egyptians working in oil-exporting Arab countries. This is relevant to gentrification as more demand for first and second homes increases the possibilities of gentrification in Cairo.

5 Methodology

Throughout the gentrification-related literature, authors have been considering the positive and negative consequences of gentrification in a way that it, sometimes, lacks the sense of relevance and application from an urban planning and architecture perspective. As gentrification is a recent field of research in Egypt, the research being described in this paper will explore new factors which affect the gentrification process in Heliopolis and historic Cairo. However, as many authors tried to find gentrification indicators, few had identified them. Meanwhile, after the researchers had investigated, reviewed, and evaluated many different indicators, they found that the gentrification indicators of Kennedy and Leonard (2001) are the most suitable for the case studies, as discussed in previously published research work. Thus, assures the research point of view: What can be applied, for example, in Saint-Henri and Lower NDG, Montréal, and Toronto, must not by default be applied to other countries due to social and cultural differences. Moreover, the researcher investigated and analyzed census data analysis from the Central Agency for Public Mobilization and Statistics reports, of years 1976, 1986, 1996, and 2006, data, such as the number of apartments, tenants, new businesses, death and birth rates, urbanization projects, within the last four decades, to indicate gentrification in the case studies. The case studies analysis used for examining the gentrification indicators is to overlap and join the urban planning survey typology (land use, heights, conditions of buildings, etc.), to compare recent studies related to the case studies, to reflect the different waves of gentrification on the case studies, and to present the results of the study population interviews.

6 Heliopolis and El Gamalia as Two Case Studies of Gentrification

Cairo as the capital of Egypt has been attracting much capital investment. Cairo witnessed urbanization, suburbanization, and deurbanization processes in different neighborhoods. Recently, Cairo is witnessing a wave of re-urbanization to regenerate the city center neighborhoods to the loss of its important urban facilities and services due to the suburbanization process. With the wave of suburbanization and the belief of having a multinuclear city center, the Heliopolis and El Gamalia neighborhoods worked as a vital nucleus and destination for many activities. Heliopolis is a vital center of the eastern part of Cairo, especially for residential, entertainment and leisure, with many cafes, restaurants, green areas, and financial administrative buildings, especially the El Korba District, while, El Gamalia, is the city center for commercial, shopping, textiles, jewelry workshops with many cafes, bazaars, restaurants, and monumental and religious buildings, especially Fatimid historic Cairo. The two case studies are characterized by their unique architectural styles. On the one hand, El Gamalia in historic Cairo with Islamic architecture monumental buildings, from the medieval ages, made it a UNESCO World Heritage Site. On the other hand, Heliopolis is characterized by its mixed architectural styles including Moorish, Islamic, and Belgian modern architecture from the beginning of the twentieth century. Figure 1 shows the location of both case studies on the middle and eastern side of Cairo. So far, the leading, primary, and secondary indicators of gentrification are used for the different analysis types below, and those types of indicators are identified by Kennedy and Leonard (2001).

Moreover, the statistical data was analyzed on different levels, starting with the demographic data and census (population, number of families, etc.) then to the housing circumstances (residential units, occupancy rates, ownership for buildings, number of units built, and housing types). Also analysis was made of the sociocultural interviews with the study of population and educational status of residents, and the economic status (economic activities and professional activities, and buildings used for work). The study population included some interviews with governmental bodies, local authority, and nongovernmental organizations. And as renting—renting refers to the rent gap which plays a very important role in the gentrification process—some interviews were done with residents in rented accommodation and owners. Some tourists and passersby were also interviewed. Thus, each type of analysis indicates the occurrence of gentrification as will be shown in the coming lines.

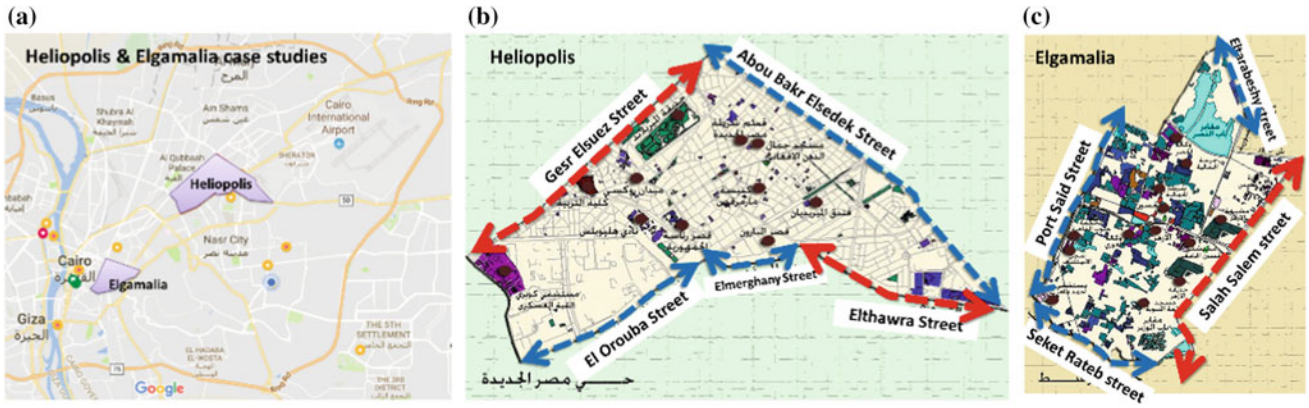

Fig. 1 **a** Location of the case studies in Cairo. **b** Heliopolis case study location and surrounding area. **c** El Gamalia case study location and surrounding area. *Source* Adapted by the researcher using CAPMAS Maps and Google maps, 2017

7 Results and Discussions

7.1 Demographic Analysis

The population of El Gamalia decreased from 166,803 inhabitants to 56,626 inhabitants, losing about 66% of its population, in the last four decades. This indicates that this neighborhood is repelling inhabitants to move from it to the neighboring neighborhoods following which the existing buildings are reused or converted to another use, which if compared with the economic activities, with the increased needs to services, proves the changing of El Gamalia from a residential neighborhood to a service and hospitality neighborhood, which calls for urban development projects by which increases the possibilities of gentrification. On the other hand, Heliopolis population increased from 127,199 inhabitants to 141,565 inhabitants in the same period, by a 10% increased population. Thus, there is a need for housing more than the need for other uses as it will be clarified in the economic analysis. This indicates that Heliopolis has more need for residential uses than El Gamalia. Also, family size, as average family members, decreased from 4.8 in 1976 to 3.6 in 2017 in El Gamalia, and from 4.3 in 1976 to 3.1 in 2017 in Heliopolis (Fig. 2).

7.2 Housing Circumstances

By analyzing the housing circumstances, gentrification is becoming more and more obvious in the case studies. Housing circumstances data provided indicated gentrification with many nationality owners for all buildings regardless of their use and it was classified to Egyptians, Arabs, and other foreign nationalities. Also, the percentage of owned or rented apartments indicates which direction the ownership is oriented in the neighborhood more rented or owned. Moreover, occupancy rates and the housing types of each case study indicate the level of housing and the number of persons per apartment. The graph showing the number of

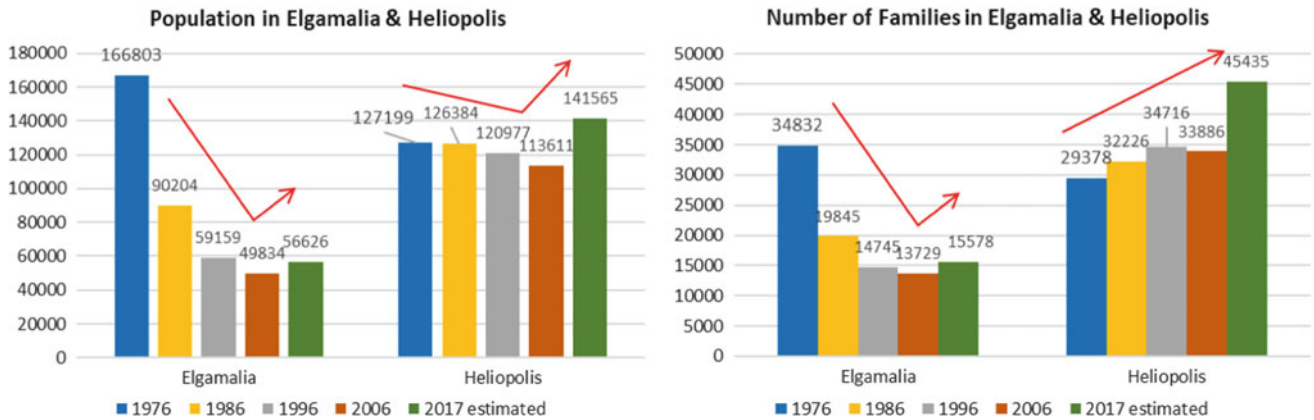

Fig. 2 Population growth and the number of families in El Gamalia and Heliopolis between 1976 and 2017 (2017 census was estimated from the Cairo statistical data). *Source* CAPMAS Census of 1976, 1986, 1996, 2006, and 2017 for Cairo then edited by the researcher using excel sheets

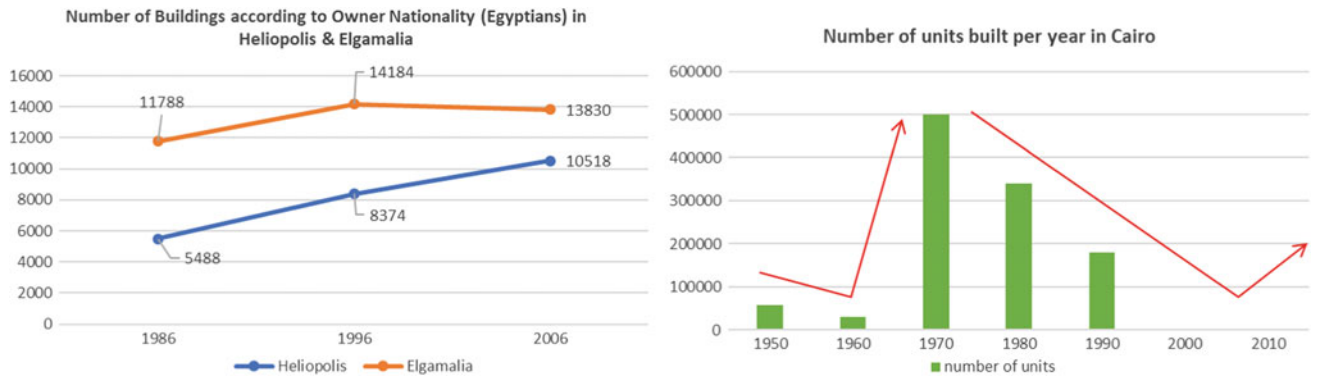

Fig. 3 Number of buildings according to Egyptian owner nationality in El Gamalia and Heliopolis between 1986 and 2006, with a comparison to the number of units built per year in Cairo between 1950 and 1990. *Source* CAPMAS Census of 1976, 1986, 1996, and 2006 for Cairo

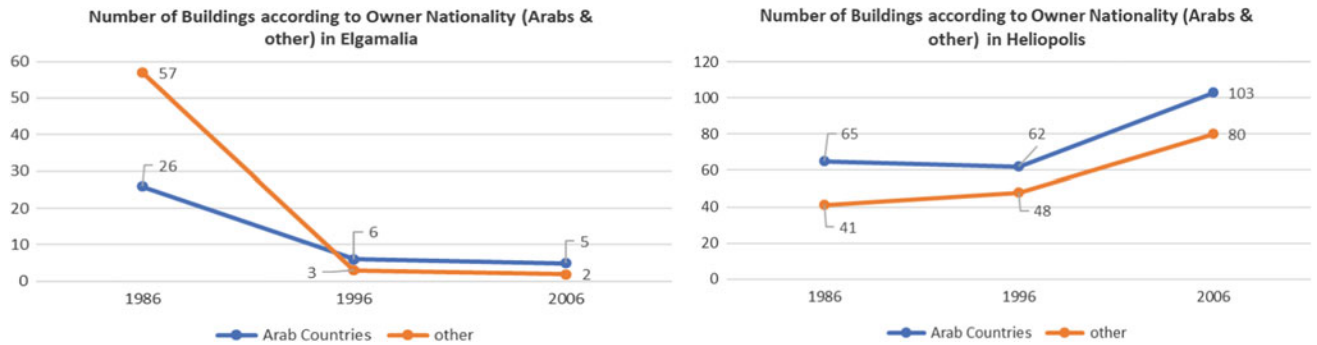

Fig. 4 Number of buildings according to owner's nationality from Arabs and other countries, in El Gamalia and Heliopolis between 1986 and 2006. *Source* CAPMAS Census of 1986, 1996, and 2006 for Cairo

buildings according to Egyptian ownership shows that there is an increase in the number of buildings owned by Egyptians in both case studies since 1986 till 2006; this increase did not affect the occupancy rate. On the contrary, the occupancy rate decreased from 2.4 to 1.18 person per room in El Gamalia while it decreased from 1.1 to 0.83 person per room in Heliopolis. This is accompanied with a general decrease in the number of units built per year in Cairo with an expectation to be increased again due to the waves of re-urbanization in the last two decades (Fig. 3).

So far, El Gamalia resists foreign investments as the number of buildings owned by foreign nationals from Arab and other countries decreased from 26 to 5 buildings only for Arabs, while it decreased from 57 to 2 buildings only for other countries, between 1986 and 2006. This contrasts with Heliopolis, which attracts more international investments due to the opening of many international financial headquarters and international restaurants and cafes. As the number of buildings owned by Arab nationals increased by almost 40%, from 65 to 103 buildings, while for other nationalities doubled from 41 to 80 buildings in the same period. Meaning that gentrification led by national gentrifiers, while in El Gamalia, gentrifiers are internationals (Fig. 4).

Since 1976, residents tend to own their apartments instead of renting them, as in both case studies, there is a tendency to own more than to rent, which considered as a primary indicator for gentrification (move from rental tenure to homeownership) even though, in El Gamalia, the rented apartments are triple the owned apartments which are normal by old and historic neighborhoods due to the old rent contracts which are slightly changing recently, for rent from 82 to 75%; due to the new-built buildings which goes much slower than in Heliopolis, this indicates that there is a strong tendency for gentrification to take place. In Heliopolis, the owned apartments increased rapidly from 10 to 43%, which indicates the rapid change in the neighborhood, but still the high percentage of rented apartments shows that gentrification takes place. Thus, displacement takes place much faster in Heliopolis more than El Gamalia case study. One of the leading indicators of gentrification is high rates of renters (see Kennedy and Leonard 2001) which clearly exist in both cases (Fig. 5).

So far, the number of residential units decreased from 34,832 to 13,707 units in El Gamalia, which means the neighborhood lost 60% of its residential units to other uses mainly services use and more ease of access to job centers

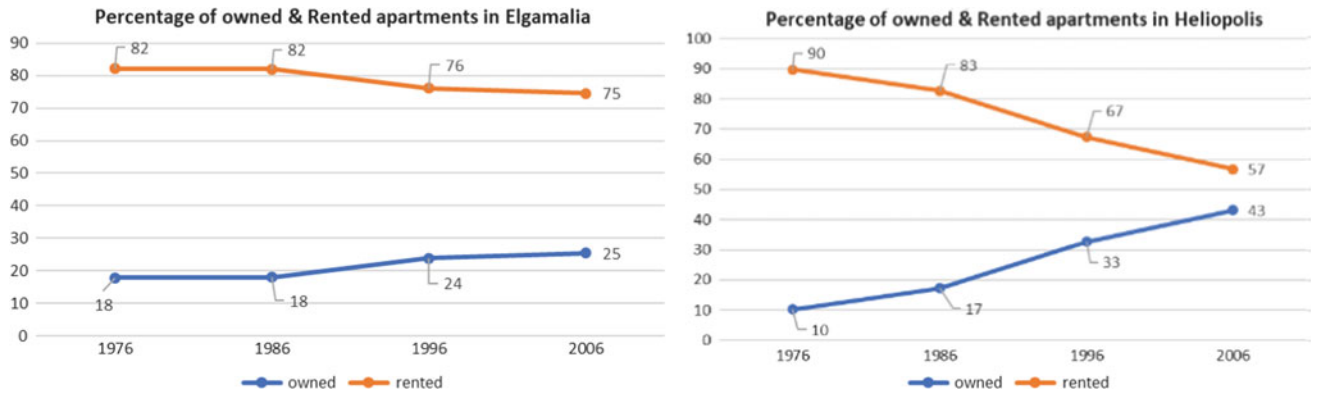

Fig. 5 Percentage of owned and rented apartments in El Gamalia and Heliopolis between 1976 and 2006. *Source* CAPMAS Census of 1976, 1986, 1996, and 2006 for Cairo

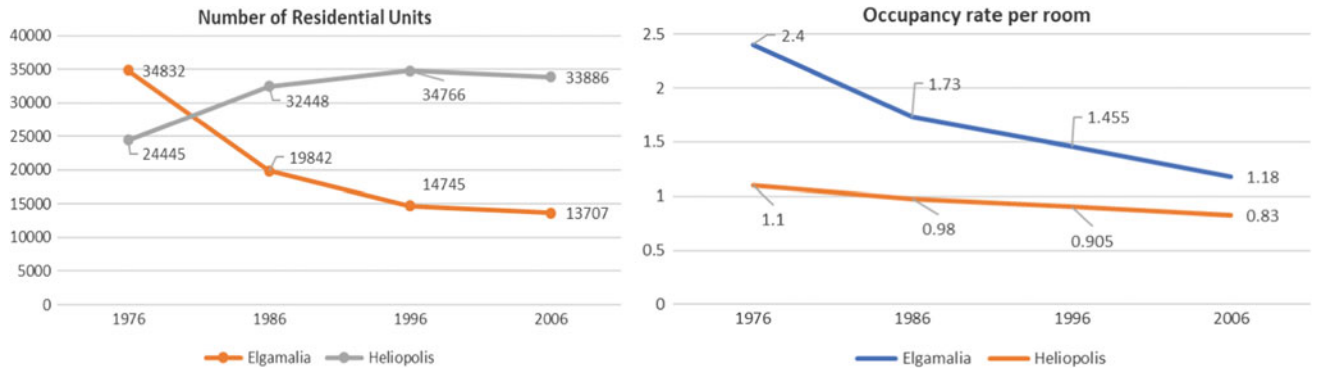

Fig. 6 Number of residential units and occupancy rate per room in El Gamalia and Heliopolis between 1976 and 2006. *Source* CAPMAS Census of 1976, 1986, 1996, and 2006 for Cairo

(leading indicators of gentrification), while the number of residential units increased from 24,445 to 34,766 and decreased slightly in the last two decades to 33,886 units in Heliopolis. Generally, the high percentage of rented apartments is converted to other use than residential that is mentioned in detail in the distribution of the economic activities and professions later in this research (Fig. 6).

The housing types in El Gamalia are categorized between houses and apartment houses with no existence of villa type of residence, as the percentage of apartment houses increased from 31% in 1986 to 42% in 2006, due to the need of housing with the tendency to have a denser neighborhood, with the loss of houses, which may indicate the openness of the neighbored for external newcomers. The same almost happened in Heliopolis as the percentage of apartment houses increased from 57% in 1986 to 68% in 1996 and stabilized to reach 69% in 2006, with a steady loss in villas each five year around 1–2% are demolished and converted to apartment houses. Thus, the real estate and contracting businesses flourish, by which the 12% increase in apartment houses is faced by a 3% decrease in villas and 9% decrease in houses, which means every 1% of turned down villas faced by 1% newly built apartment houses, which in numbers of housing types each turned down villa or house a 1.6 apartment house is built (Fig. 7).

7.3 Sociocultural Analysis

The sociocultural analysis dealt with the residents and outsiders to realize the behavior, traditions, and habits of the case study users and residents as well. By interviewing, the interviewees seemed to be open and welcoming in Heliopolis more than in El Gamalia case study, maybe due to the openness and exposure of the neighborhood to visitors and residents who belong to different backgrounds. The replies of residents to questions related to buildings which have architecture values and had been sabotaged were worried and panicky sometimes. As they seemed conservative toward some social behavior of visitors who tend to misuse the calm environment that Heliopolis used to enjoy which nowadays has changed to noisy, harshness, and sometimes vulgarity. Education is considered a vital indicator for the neighborhood's development and level of residents who are

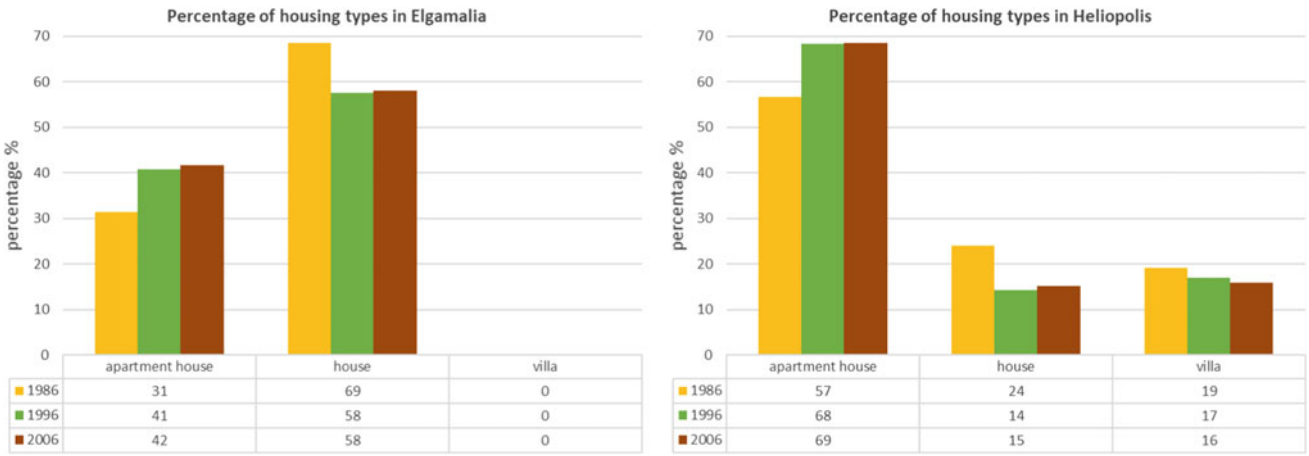

Fig. 7 Percentage of housing types in El Gamalia and Heliopolis between 1986 and 2006. *Source* CAPMAS Census of 1986, 1996, and 2006 for Cairo

the gentrifiers of the case studies. The sociocultural analysis represents the educational level and status of the residents, culture, habits, and behavior. The social behavior, culture, and habits were identified from the interviews which have been conducted in previous researches and summarized here. As an indicator for the change in cultural identity and habits in El Gamalia and Heliopolis, respectively, what was mentioned by one of the interviewees is that 'I have lived here for almost 45 years, I like this place so much this is my home, I do not like to move from here, there are many mosques, my mosque is 20 m far from my house, I can practice my religion everyday' (local resident 2015). And in Heliopolis, 'Heliopolis witnessed a wave of *Ruralization* due to the migration of inhabitants from delta villages to Cairo in general and Heliopolis specifically that changed the traditions and daily life of what I used to see in my street. Adding that, the new inhabitants arrived to Heliopolis during the last two decades' (local resident and expert in Architecture 2017).

The following graphs show the educational status in both case studies, for the period between 1976 and 2006. In El Gamalia, there is a noticeable increase of the percentage of residents with university degrees, as they increased from 1.5% in 1976 to 11.4% in 2006, which means they have been eight times more than in 1976. Moreover, the percentage of residents who have only elementary education has declined from 10.1% in 1976 to only 0.3% in 2006 and also with a decrease in illiterates from 48% to only 27%, during the same period. Generally, the residents of El Gamalia are becoming more educated than before (Fig. 8).

In Heliopolis, there is a noticeable increase of the percentage of residents with university degrees, as they increased from 18.1% in 1976 to almost 49% in 2006, which means they have been 2.7 times more than in 1976 and also

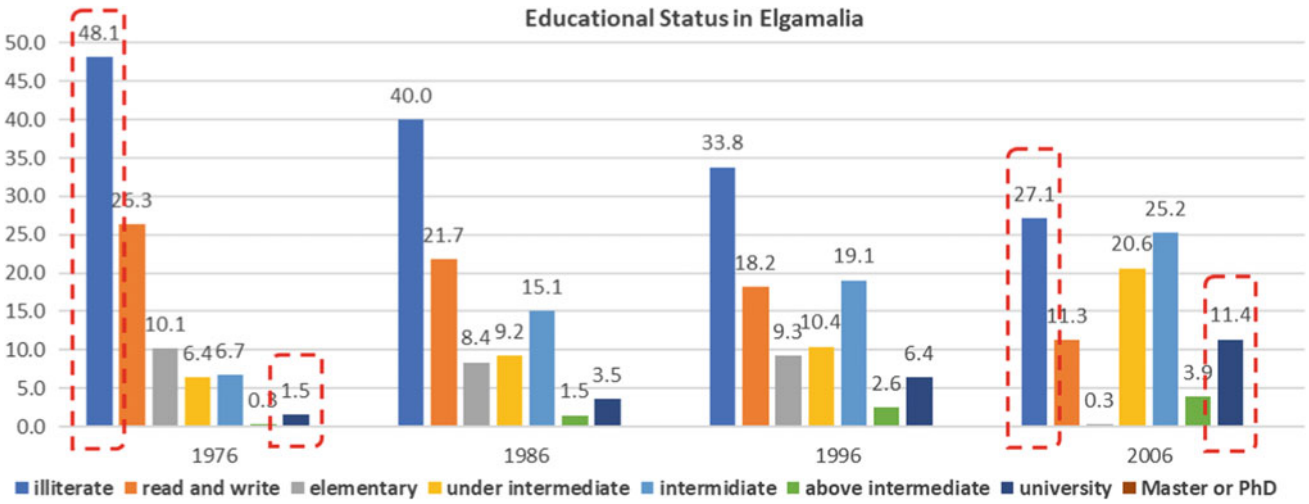

Fig. 8 Educational status in El Gamalia between 1976 and 2006. *Source* CAPMAS Census of 1976, 1986, 1996, and 2006 for Cairo

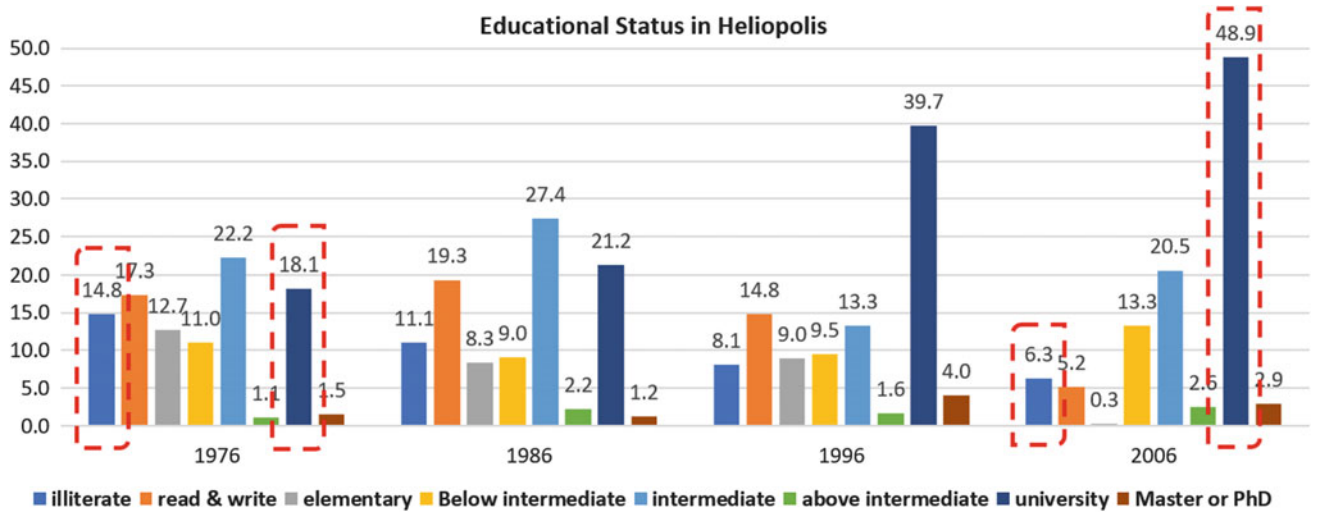

Fig. 9 Educational status in Heliopolis between 1976 and 2006. *Source* CAPMAS Census of 1976, 1986, 1996, and 2006 for Cairo

with a decrease in illiterates from 14.8% to only 6.3%, during the same period. Moreover, the percentage of residents who have only elementary education has disappeared from 12.7% in 1976 to only 0.3% in 2006. Generally, the residents of Heliopolis are becoming more educated than before, and they are more educated in general than in El Gamalia (Fig. 9).

7.4 Economic Analysis

The economic analysis shows the different economic sectors and activities that each case study has, regarding the residents who are living in El Gamalia and Heliopolis. The economic activities indicate the main identity of the community that is living in the case study areas, while the professional activities indicate the real professions that the residents really work with. Accordingly, in El Gamalia, the economic activities are depending on three main sectors, industrial, trading and hospitality, and services, and then construction and transportation come later. The main three sectors represent around 85% of the economic activities. Even there is a gradual stable decrease in industrial activities from 35% in 1976 to 26% in 2006, while trading increased from 27% in 1976 to 35% in 2006, and services increased generally from 25% in 1976 to 31% in 2006 with a noticeable increase in 1986 with the booming open-door policy at the beginning of the 1980s. Moreover, construction activities have decreased from 8% in 1976 to 4.5%, then increased to reach 6.4% in 1996, and then decreased again to reach 4.1% in 2006. This indicates the instability of construction activities due to the supply and demand of the real estate market. Thus, the El Gamalia neighborhood leading sector is the trading and hospitality then comes the services, this is due to the increased number of commercial activities and stores for textile companies.

On the other hand, in Heliopolis, leading activities are services which only represent more than 55% of the economic activities alone, in the last four decades, with a noticeable increase in trading and hospitality activities which increased from 13% in 1976 to reach 23% in 2006 and also with a slight decrease in the industrial activities to be 9.8 in 2006 from 12% in 1976. Thus, the community in Heliopolis is a community of services, which may be obvious with the change from residential to commercial, leisure, and administrative activities. Thus, changing income shows the presence of a secondary indicator of gentrification (Fig. 10).

The distribution of professions in El Gamalia and Heliopolis indicates the need for professions according to the mentioned activities. So far, El Gamalia's boom for the need of factory workers and machine operators in 1976 which represented 47% soon decreased to 35% in 1986 and then to 33% in 2006, and also with another boom in construction workers in 1986 from 6% in 1976 to 22% in 1986. This was due to the shift from an industrial country to a country relying on segmented sectors such as tourism, services, administration, and finance, by which the need to technicians and scientific professional, and service workers in much more efficient than working in a factory. Even, in Heliopolis, the need for legislators, seniors, and professional technicians is more obvious as it increased from 36% in 1976 to reach 57% in 2006, accompanied by a slight increase in services professions and construction workers. Therefore, the public workforce in El Gamalia decreased from 29% in 1986 to 22% in 2006 and in Heliopolis from 44 to 31% within the same period, thus giving more opportunities to private, national, and international investments and real estate to flow (Figs. 11 and 12).

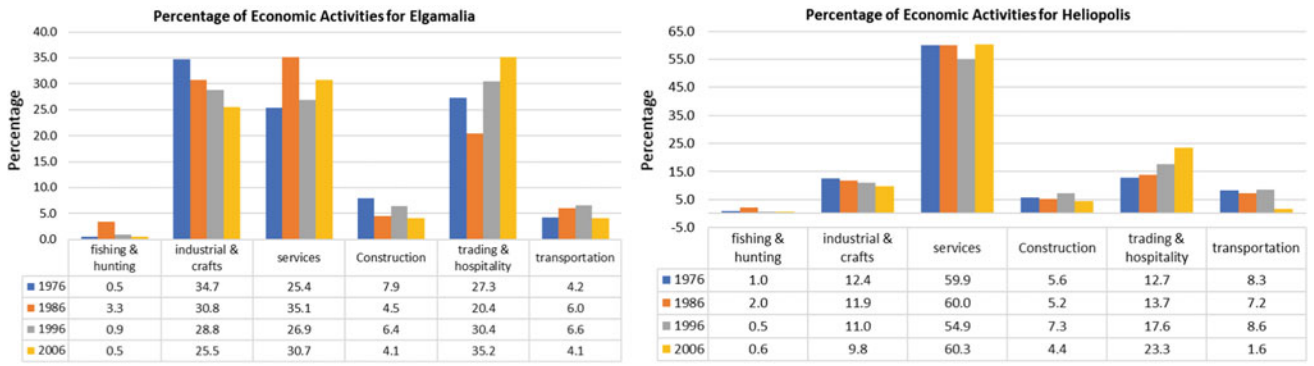

Fig. 10 Percentage of economic activities distribution, in El Gamalia and Heliopolis between 1976 and 2006. *Source* CAPMAS Census of 1976, 1986, 1996, and 2006 for Cairo

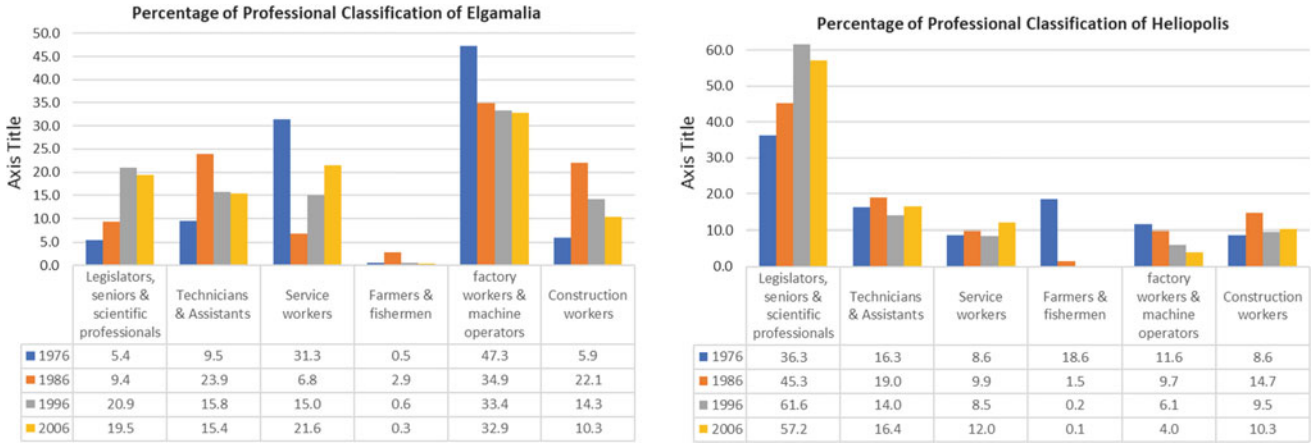

Fig. 11 Percentage of professions distribution, in El Gamalia and Heliopolis between 1976 and 2006. *Source* CAPMAS Census of 1976, 1986, 1996, and 2006 for Cairo

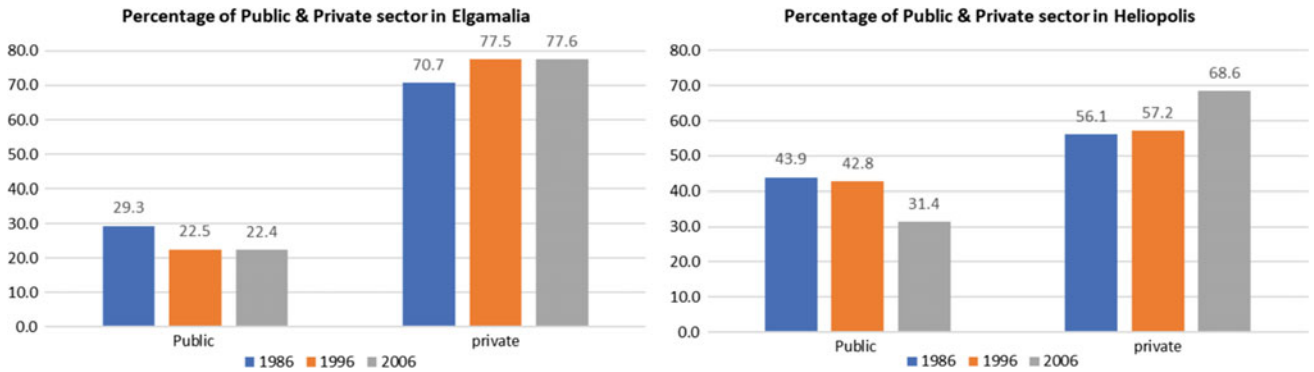

Fig. 12 Percentage of public and private sectors, in El Gamalia and Heliopolis between 1986 and 2006. *Source* CAPMAS Census of 1976, 1986, 1996, and 2006 for Cairo

7.5 Physical Analysis

Exploring the typology of both cases helps to understand and predict the locations which may be exposed to coming gentrification process. Physical analysis was done by the previous research to have a whole overview of the gentrification process in the case studies area, a total area of 46,5253 square meters (111 Fadden) in the Historic City of Cairo, El Gamalia case study, and 20,9122 square meters (50 Fadden) in El Korba, Heliopolis case study. The geographic

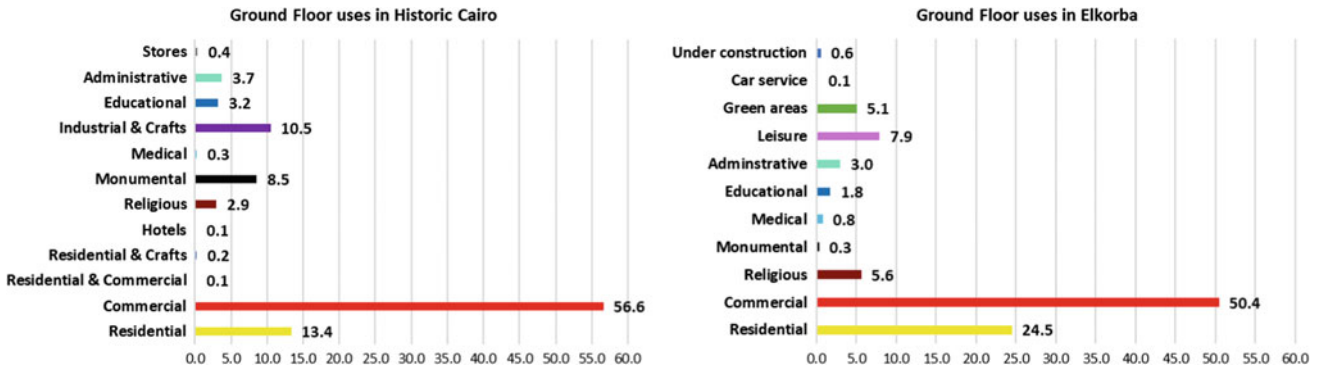

Fig. 13 Percentage of ground floor uses, in Historic Cairo and El Korba. *Source* The researcher depending on survey data made in 2015 and 2017

information system (ARC GIS) was used for analyzing the data for land uses, heights, conditions, and building materials of buildings on both case studies. Accordingly, the land use for the ground floor of Historic Cairo showed that 56.6% of the built-up area is used for commercial purposes while in El Korba District it was 50.4% for the same purposes. After the commercial use comes the residential use with 13.4% and 24.5% in Historic Cairo and El Korba, respectively, as the second highest ground floor use. In the third place, industrial and crafts use with 10.5% in Historic Cairo, and leisure activities and entertainment use with 7.9% in El Korba (Fig. 13).

Moreover, the survey showed that the heights of buildings in El Korba are more than those in Historic Cairo. Historic Cairo's buildings in the range between 9 and 13 floors represented 1.1% only while in El Korba reached 5.8% of the buildings. Such difference in height range is due to the wider range of streets in El Korba more than in Historic Cairo, thus allowed more height allowance while the percentage of buildings between 1 and 2 floors is almost the same in both the case studies, 50.8 and 49.2%. The building structural system of Historic Cairo ranged between concrete skeleton, bearing walls, and light structured as 60.4% of the buildings are built with reinforced concrete while, on the other hand, 62% in El Korba. Bearing walls represented almost the same percentage in both cases, 39 and 38% in Historic Cairo and El Korba, respectively. This is due to the historical background of both cases as the common building systems which allow more formation and ornaments using bearing walls regardless of the time while the modern structure tends to use concrete frames. Meanwhile, more focus and importance have been given to Heliopolis because the medium conditions of buildings reached 43.4% in Historic Cairo while only 7.2% in El Korba. Even more, partly destroyed and bad condition buildings 6.9% and 0.5% can be found in Historic Cairo, while in El Korba this is not the case (Fig. 14).

8 Concluding Remarks

It is essential to mention that the researcher is not pro or against gentrification rather than trying to legitimate a process which may cause urban planning disasters due to a lack of a comprehensive methodology. Moreover, according to the demographic, housing circumstances, sociocultural, economic, and physical analysis, it was found that both case studies are highly exposed to gentrification process, even that gentrification is proceeding much faster in Heliopolis due to more attention given to it, as during the research is written, the Merrylands Garden is going to open in the next few months after it has been regenerated with modern full furnished landscape, which needs more research to evaluate and understand the effect of it on the ongoing gentrification process. The main type of gentrifiers in Heliopolis is different than in Historic Cairo. In Historic Fatimid Cairo, the main gentrifiers are merchants, restaurants and café owners, and traders, due to the uses and activities which are already in high demand for investors. While in Heliopolis, the main gentrifiers are investors interested in financial, leisure and entertaining activities, also young families with one or two children. El Gamalia is led by commercial gentrification due to the increased need and demand for commercial uses, while Heliopolis is led by residential gentrification due to the increased need and demand for housing use.

Gentrification in Egypt is processing in a different way than the core cities. Firstly, no one knows about the term 'gentrification'. There is no translation to the Arabic language except the insight of Muhammad Eldaidamony (2017) to translate the term to Arabic (see also https://ar.wikipedia.org/wiki/استطباق#cite_note-2). Elwakil Shafak (2015) argued that the term is much related to 'replacement,' while as gentrification's positive and negative consequences differ from replacement. Thus, no one resists the gentrification process, as far as it is unknown, inhabitants do not have the

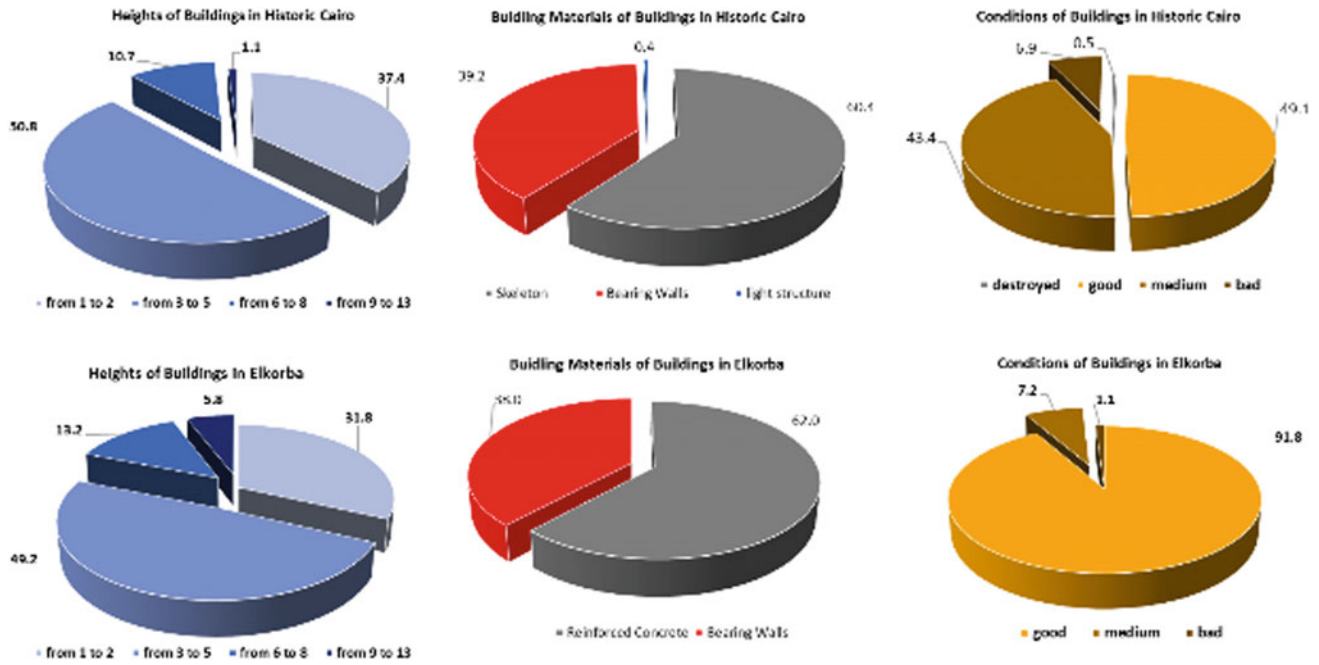

Fig. 14 Heights, percentage of heights, building materials, and conditions of buildings in Historic Cairo and El Korba. *Source* The researcher depending on survey data made in 2015 and 2017

opportunity to struggle against it. Secondly, on an economic basis, gentrification is a very powerful tool to increase the income of the gentrification mediators and stakeholders, such as local businesses, contractors, and developers. Thirdly, gentrification is happening gradually and slowly in Cairo; thus, it is important to understand the process to proclaim and legalize it, to get as many positive consequences and avoid the negative ones, by providing alternatives for the displaced inhabitants.

Moreover, gentrification can be defined in the context of Egypt as 'it is a process that drives economic activities, to benefit, on the one hand, the stakeholders, newcomers, policy makers, investors, and by purchasing renewed properties to enjoy the better quality of life in a livable urban environment. On the other hand, the mediators get better direct job opportunities and increase their income, working in a better quality neighborhood, and indirect complementary job opportunities, such as small investors, workers, and local contractors. All this happens secretly (behind the scenes) and hiding under the umbrella of other urban models (regeneration, renewal, rehabilitation, etc.) beyond gentrification, regardless of the displaced population while the displaced population tends to hide and accommodate with the new urban life, which explains the slowness of gentrification.'

For further research purposes, more analysis needed to identify the different types of gentrifiers and the causes of gentrification. Also, psychological analysis should have been taken into consideration concerning murder and crime rates and segregation factors. So far, the social and cultural analysis needs more research from sociologists and geographers to identify the types of specific habits and tradition changes. The geographic information system (GIS) as a tool for analysis and to deduce gentrification locations is considered useful and fruitful, and more is to be expected from the analysis tools it offers, in further research. Finally, gentrification considered before as a haphazard process in some cases could be managed and controlled for the benefits of the inhabitants. This will overcome and decrease displacement and social segregation of gentrification and maximize the benefiting of its positive consequences, improved urban life and new investments and prospered economic activities.

Finally, the researcher tried to differentiate between different urban models and expressions used in urban planning and projects, as gentrification is a different approach which needs more case studies to be conducted to draw a full map to its consequences in Egypt. The two new added geographies of gentrification, historical-tourism gentrification and real estate/contracting gentrification, will open further research fields and rich the literature of gentrification in the future. Beside gentrification's positive consequences, it lacks quality and consideration conservation and cultural differences. If there is no way for gentrification to happen, it has to go hand in hand with conservation in order to conserve the historical buildings.

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Applying the Gentrification Indicators in Heliopolis District

Muhammad Eldaidamony, Ahmed A. A. Shetawy, Yehya Serag, and Abeer Elshater

Abstract

Five decades since the word "gentrification" was coined in 1964, academics have approached gentrification as a haphazard process. From the turn of the twenty-first century, gentrification is not perceived as a haphazard process but rather a planned, well-defined and organized process. It has been recognized that gentrification does not proceed the same everywhere. While urban neighborhoods are exposed to gentrification, physical, economic, social and cultural changes take place. Gentrification can also proceed reversely that is called as "degentrification." There is a common agreement between scholars and practitioners that gentrification leads to the improvement of urban life, facilitates urban neighborhoods and reducing the likelihood of future demolition and provides a practical solution for deteriorated neighborhoods, but it has also some negative consequences; the most significant is displacement. This paper deals with the problem of what so-called geography of gentrification, which suggests need to understand the dilemma of how gentrification evolves and develops within neighborhoods in different cities. Moreover, this paper explores the application of the gentrification indicators on Heliopolis district in Cairo in order to understand the process of gentrification.

Keywords

Degentrification • Gentrification • Heliopolis • Urban neighborhood

1 Introduction

Gentrification has been evolving within urban neighborhoods for 50 years ago, first when Ruth Glass coined the term in 1964. The notion of gentrification has been through many transformation processes and waves which enrich the literature of urban planners, geographers' gentrification, on the consequences and dynamics of gentrification. As far as gentrification is a planned process, sometimes it is very difficult to control and speculate upon its consequences, due to many reasons—economic, sociocultural and political sometimes. On the one hand, as far as gentrification leads to the improvement of urban life, on the other hand it re-arranges and increases urban facilities in the neighborhoods as well. Clearly, gentrification increases overcrowding and puts stress on urban infrastructure leading sometimes local inhabitants to leave their own neighborhood seeking calmness and more open spaces in distant neighborhoods leading to waves of suburbanization.

This paper tackles the problem of what Lees (1996) called "Geography of Gentrification," which makes an urgent need to understand the dilemma of how gentrification evolves and develops within neighborhoods in different cities. Moreover, this paper explores the application of the gentrification indicators developed by Kennedy and Leonard (April 2001) on Heliopolis to understand the process of gentrification. As many authors agreed that the secret of regenerating the study of gentrification stems from exploring new case studies of cities, cities which witness gentrification with a totally different circumstances and context. The environment in the Egyptian case study facilitates gentrification giving it new prospects to explore. Even though gentrification has negative consequences, sometimes it is condoned due to the more concrete positive consequences it achieves.

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2 Prologue

The term "gentrification" firstly appeared in an essay on the urban dynamics in Inner London by Ruth Glass in 1964. She described gentrification as the invasion of the middle class who replaced the working class and the renovation of residential houses. She pointed out how rapid the appearance of the whole changes in such neighborhoods and states. Glass noticed how gentrification is spreading to other surrounding neighborhoods. While in terms of demography, economy and politics, the pressure gentrification puts on central London, it was clear that she was revealing her point of view on a small scale, assuring what kind of changes is going on, in-between social classes, and not about a "back to the city center" movement. That kind of gentrification was called "classical gentrification." Classical because of its scale and nature of the process, it was simpler than nowadays.

As gentrification got more and more sophisticated, the definition has been through many changes till the most recent definitions by Brown-Saracino (2010) in his book *"The Gentrification Debates."* As he explained, gentrification is characterized by the movement of creative professionals, such as artists and writers, and, later, of other members of the middle class, such as educators and bankers, to central city neighborhoods in search of affordable housing near museums, music venues and other cultural attractions that they value. Accordingly, people move into low-rent areas populated by working-class individuals who are often members of white ethnic or racial minority groups, as sometimes these in-movers purchase homes that they renovate or restore to satisfy their needs and tastes.

And lately the definition by Eldaidamony and Shetawy (2016) proposes gentrification as "an urban process that aims to improve urban life, which could be managed by the government or investors or even residents belonging to a higher class, than the class already existing in the neighborhood. As the existing neighborhood of that class, somehow, tends to be gentrified, the gentrified building(s) becomes a spotlight of interest, when the manager (gentrifies) and the place both have the motivation and ability to be gentrified synchronously. All this happen without giving attention to gentrification's negative consequences, likely as social segregation, destruction of social classes and displacement."

The early-stage models of gentrification were introduced by Phillip Clay (1979). Clay studied the private reinvestment in the core of US cities in the 1970s, as four stages (cases) of gentrification were discovered: pioneering gentrification, expanding gentrification, adolescent gentrification and maturing gentrification. Clay's model described the way gentrification evolved in the 1980s and 1990s. So far due to time and different changes (economic, social, political changes), a new stage of (super) gentrification was developed recently.

The movement of both capital and people formed two different notions of theories of gentrification. As Smith (1979) argued that gentrification is the reinvestment into rundown neighborhoods rather than moving back to the city center for the middle-class people by introducing a theory of investment and reinvestment. The argument Smith puts forth in the article that disinvestment in properties in certain central city neighborhoods produced a gap between current and potential land rents and therefore enabled investors, from individual gentrifiers to investment firms, to profit by investing in or speculating on such properties, which is arguably among the most influential pieces of gentrification scholarship to date. On the other hand, Brown-Saracino argued that the people are taking advantage of this returning capital from the city. If the city continues to attract productive capital (whether for residential or other construction), we may witness a fundamental restructuring of urban space comparable with suburbanization. Then, indeed, it would become a back to the city movement by people too that is middle- and upper-class people—while the working class and the poor would inherit the old declining suburbs in continuation of the filtering process.

Moreover, gentrification has both positive and negative sides; Atkinson and Bridge (2005) mentioned some of the positive and negative sides of gentrification. On the one hand, gentrification increases social mix, increases property value and loss of affordable housing, reduces crime rates and reduces urban sprawl. While on the other hand, gentrification facilitates the loss of social diversity (from socially disparate to rich ghettos) and also increases the demand on housing units for the displaced inhabitants who tend to move to the surrounding poor areas.

Meanwhile, to identify, indicate and detect gentrification in urban neighborhoods, some gentrification indicators needed to be defined in order to determine such neighborhoods. Accordingly, there were four major studies that addressed the neighborhoods of Saint-Henri and Lower Notre-Dame-de-Grâce (NDG) in Montreal, Canada (Ley 1996; RESO 2002, 2007; Walks and Maaranen 2008). The work of the Report of the Southwest Housing Committee (RESO 2002, 2007) documents that in the Southwest Borough in Montréal, of which the Saint-Henri neighborhood is a part, there were sharp increases in housing prices between 2001 and 2005. And as Ley (1996) relies on a different methodology than the work of RESO, his analysis compared gentrification of six Canadian inner cities from 1971 to 1991, using special tabulations based on Canadian census data. Before the Report of the Southwest Housing Committee in 2002 emerged, another research was done by the Urban Institute, District of Colombia Policy Forum in 2001, in the District of Colombia neighborhoods, and as a result, five leading indicators of gentrification were discovered. Later,

Walks and Maaranen (2008) presented an assessment of neighborhood gentrification and upgrading in Toronto, Montréal and Vancouver cities. The study was divided into stages over the period 1961 till 2001, using indicators from the Canadian census. The aim of the study was to detect the presence of gentrification and upgrading processes, as six indicators were used (Walks and Maaranen 2008: 10).

Gentrification indicators are various and diverse, meanwhile Kennedy and Leonard (2001) categorized gentrification indicators to three main types, leading, primary and secondary indicators. After research and comparing various indicators, Kennedy and Leonard's indicators were preferred to be examined. They are very convincing and more applicable to the case study of Heliopolis, also due to the absence of a comprehensive approach to deal with such neighborhoods. Table 2 shows the three different types of indicators, with interpretations from the study population mentioned in Table 1. Believing that gentrification cannot be applied everywhere similarly, due to culture and social differences, as referring to the type of gentrifiers whose sexual preferences may have (gays and lesbians) that cannot be measured nor applied in Egypt. Also, the notion of that, no idea to where will move the displaced inhabitants (homeless), homelessness is not the issue in Cairo. As the dilemma of gentrification does not rely only on its definition but more on the case studies, the researchers tried to investigate. Thus,

Table 1 Study population, methods and sampling techniques

Study population	Methods	Sampling techniques	Number of interviewees
Heliopolis for housing and development	Semi-structured interviews	Purposeful then snow-balling	1
National organization for urban harmony			2
Local authority			1
Housing and building national research center			1
Apartment owners	Unstructured interviews	Stratified random sampling then snow-balling	4
Shop owners			6
Local residents		Purposeful	15
Renters			5
Heliopolis heritage (NGO)			2
Users, passing by, others, etc.			10

Table 2 Following table summarizes the analysis and examination of gentrification indicators on Heliopolis (determined and developed by the researcher, 2013 and adapted for 2017)

No.	Gentrification indicators	Yes	No
1	**Leading indicators: areas most likely to experience gentrification**		
A	High rate of renters *"The area has a lot of renters who is renting their properties with a very low-price range between 2* and *5 Egyptian Pounds monthly (0.1–0.27 US Dollars monthly), which by time converted to an ownership, the renting contract was an unlimited contract by which the renter can inherit the apartment to his sons and grandsons as well, as time passed the original owner maybe died or forgot about the property"* Local resident which was also assured from the interviews with experts *"Heliopolis is changing now from being a neighborhood with a high percentage of renters to ownership due to the deterioration of many buildings (villas and houses) which had been demolished and new buildings replaced them. The new buildings are sold to newcomers who are looking for a diverse and culture facilities in Heliopolis"* Housing and building national research center expert	Yes	
B	Ease of access to job centers *"The neighborhood of Heliopolis is characterized by the existence of many different uses entertainment, leisure, administrative such as banks and companies headquarter, restaurants, shops which sells spare parts of cars, gold accessories and cloth, wedding dresses, many Christian churches, Catholic, Armenian, Orthodox, protestant, schools, and other services"* Local authority	Yes	
C	High and increasing levels of metropolitan congestion *"Heliopolis has a perfect location for business and a good market for our products, the area around here getting more and more customers which means more sales and more profit as well"* Car spare parts shop renters *"generally, Heliopolis is crowded due to many facilities it has, but specifically by the end of the week namely Thursdays and during the holy month of Ramadan before and after the 2 feasts the streets are overcrowded because of passing by and visitors who hang out here or families who would like to have their lunch or dinner by the restaurants, or get a drink by the cafes which are spreading is all over the neighborhood especially at summer nights"* local residents	Yes	
D	High architectural value *"the architectural values of Heliopolis is very unique as it represents a mix between the Moroccan, traditional Arabic, Persian architecture, and European Neoclassical architecture styles"* Heliopolis heritage (NGO), apartment owners and interviewees which may reflect the awareness toward the importance of Heliopolis architectural value	Yes	

(continued)

Table 2 (continued)

No.	Gentrification indicators	Yes	No
E	Comparatively low housing values *"... With an interesting mix between the old unique architectural styles and the new built high-rise buildings which lack sometimes to the aesthetics of architecture, appeared that distorted architecture without any style"* Housing and building national research center expert and national organization for urban harmony *"most of the low value housing appeared because of the misuse or lack of maintenance due to the faraway kinship between the current user and the owner" local* residents		No
2	**Primary indicators: strong signs gentrification is occurring**		
A	Move from rental tenure to homeownership *"... my ex-apartment was rented until I moved to Heliopolis with my family, the building is a new built one since 2008, I have to say that here is more comfortable for me and my family we can go walking around safely ...."* Local resident	Yes	
B	Arrival of individuals or households interested in urban amenities/culture *"I bought my apartment in 2015, when I moved with my family from Abbasia neighborhood to Heliopolis, because my children are in the French school in Heliopolis and it's a half way between my work and my wife's work"* Local resident (new comer to Heliopolis)—Abbasia neighborhood is located western of Heliopolis with 2 campuses of Ain Shams University, it is considered to be a working-class neighborhood	Yes	
C	Increase in businesses intended for high-income people *"the neighborhood has a good mix of small and big brands of restaurants and cafes, for example you can find Hind Koshary restaurant and McDonalds, Coffee Shop company with its big terrace towards the Basilica in Alahram street, and small cafes where working class people used to hand out, not only that but also many other examples"* Local authority	Yes	
3	**Secondary indicators: less strong signs gentrification is occurring**		
A	Change in racial composition *"Within the last years, and due to the war in Syria, many Syrians had joined the neighborhood even by renting or buying apartments to live nearby their new businesses when they work or open a restaurant selling traditional Syrian meals, no one can regret the opening of many restaurants which sells that kind of food, adding to that the original nationalities who used to live in Heliopolis when it was built beginning of the 20th Century"* Shop owners and renters	Yes	
B	Change in occupancy rate	Yes	
C	Change in income *"the new built buildings are mainly sold to newcomers during the stages of construction by credit meaning the new residents pay for example 25% of the total price of the apartment then pay the rest 75% on a period from 2–5 years, the average price for square meter is from 12–15 thousand LE (equivalent to 700–880 US Dollars)"* Local contractors which was assured from residents as well (gentrifiers)	Yes	
4	**Other indicators the researcher would like to test**		
A	High level of education *"the level of education for the inhabitants at the age of education, in general, is high, as about 55% of the population have university certificates, 20% has elementary education, 20% achieved some kind of diplomas or middle education, and 5% are uneducated"* Central agency for public mobilization and statistics	Yes	
B	Change in tradition and customs *"Heliopolis witnessed a wave of Ruralization due to the migration of inhabitants from delta villages to Cairo in general and Heliopolis in specific, that changed the traditions and daily life of what I used to see in my street adding to that the new inhabitants who arrived to Heliopolis during the last two decades"* Local resident and expert in architecture	Yes	
C	Diversity of visitors *"visitors like to visit Heliopolis to enjoy the leisure activities in it"* *"most of the visitors are from young people or young families"* *"I really enjoy hanging out here, walking around, especially at night to feel and live the uniqueness of Heliopolis"* Some residents and visitors	Yes	

applying gentrification indicators on historic Cairo in a previous research by Eldaidamony and Shetawy in 2015, then on Heliopolis, is a way to understand the process of gentrification more.

3 Methodology

All through the gentrification literature, authors have been considering the positive and negative consequences of gentrification in a way that it lacks sometimes applicable case studies with an eye of the urban planner or architect. As gentrification is considered to be a recent field of research in Egypt, the researchers will explore new factors which affect the gentrification process in Heliopolis. Whereas few authors struggled to classify and identify gentrification indicators, by investigating, reviewing and evaluating many different indicators, the researcher determined that the indicators of Kennedy and Leonard (2001) are the most suitable for the case study of Heliopolis, due to the absence of a

comprehensive approach in the case studies that Ley (1996) and Walks and Maaranen (2008) used the theme that assures the research point of view: What can be applied, for example, in Saint-Henri and Lower NDG, Montréal and Toronto, must not by default be applied to other countries due to social and cultural differences.

The methodology used for examining the gentrification indicators is to overlap and join the urban planning survey typology (land use, heights, conditions of buildings, etc.) of Heliopolis with the indicators of gentrification to achieve the main objective of the paper. In this case, the main objective of this paper is to understand how gentrification is proceeding within the neighborhood of Heliopolis. Also, to compare recent maps with maps from the beginning of the twenty-first century especially 2008 after Heliopolis reached 100 years from the date when it was first established in 1908, as according to the Egyptian law number 144 for 2006, any building aged 100 years had been added to the monument list of Cairo buildings, while during this period many buildings had been demolished and replaced with other ones. Furthermore, to predict recent and future gentrification locations, to consider the possible precautions to deal with gentrification with practical and physical data and also to avoid the negative consequences and using its positive ones to elevate and develop neighborhoods that are exposed to gentrification, this methodology was applied on the case study of Heliopolis (as shown below), then to examine with the gentrification indicators to realize the level of gentrification Heliopolis exposed to.

4 Case Study of Heliopolis

The Egyptian capital of Cairo has been attracting many investments. Cairo witnessed urbanization, suburbanization and deurbanization processes in different neighborhoods. Recently, Cairo is witnessing a wave of re-urbanization which regenerates the city center neighborhoods which for a short period of time lost they are important of urban facilities and services due to the suburbanization process. Consequently, it leads to increase of density and more pressure on infrastructure which sometimes is not eligible to accommodate that kind of re-urbanization process. Since the beginning of the twentieth century, Heliopolis was designed as a suburban neighborhood on eastern Cairo with the wave of suburbanization and the intention of having a multinuclear city. Nowadays, Heliopolis is a vital and important location which attracts many to visit and experience the soul of valuable architecture and heritage. In addition to architectural values, Heliopolis also is an iconic spot for young people to practice many activities, due to the existence of many urban facilities, such as shopping malls, restaurants, cafes, retailers and cinemas.

Heliopolis is in the northeastern region of Cairo, between a few main streets, Salah Salem, El Orouba, El Merghany and Elthawra streets from the south, Abou Bakr El-Sedeek street from the north east, and Gesr El Suez street from the northwest as shown in Fig. 1. Heliopolis is a perfect example of an existing neighborhood which enjoys many services and facilities that enhance inhabitants and visitors to enjoy and experience the closure of entertainment and leisure activities. The district of El Korba is the focus of this research; the district is popular with its restaurants, cafes, clothes shops, supermarkets, cinemas and shopping malls as well. It is an attractive and vital destination for leisure and entertainment activities in Heliopolis. Most of the visitors are young people who seek to enjoy the environment of architectural value with entertainment activities; they come to hang out, sit by a café or eat at a restaurant, watch a movie or walk around. Adding to that there are two special zones, first zone is the zone of the small and big jewelry shops next to each other while the second zone is the zone of the car spare parts and car cassettes shops at Damascus street. In our opinion, the two zones have totally different interests regarding land-use zoning homogeneity. Thus, shop owners tend to have storage spaces in the first floor of their shops or nearby locations. So far, El Korba district is diverse in economic facilities while there is also a chance for possible deterioration opportunities due to lack of comprehensive approach. That approach to accommodate the different land uses with the local inhabitants' needs and services as well (Fig. 2).

4.1 Case Study Analysis

In this part, the paper will introduce the analysis of the case study; two methods were used to explore the case study in order to discover the current situation, firstly by interviewing some of the stakeholders who are involved in the study area, as the area is popular by its entertaining and leisure activities with commercial activities as well beside the residential uses (El Korba district) which make it a significant destination for many tourists and youngsters to visit, nevertheless a headquarter for many jewelry workshops and showrooms, also as an open market for spare parts, moreover a market for textile goods such as sheets, towels, blankets and other similar products. Accordingly, many stakeholders are involved in such area, which make the researcher widen the scope of his study population as much as possible.

Secondly by exploring the typology of the case study's buildings' conditions, heights, uses and construction system used (with the aid of Geographic Information System software—ArcGIS) as exploration helps to understand the locations which may be exposed to near gentrification process. Also with some comparison between old and new maps of some buildings of high architectural value which were torn down, then highly dense 10-story buildings were built instead. While this analysis will be joined with the

Fig. 1 **a** Location of the study area in Cairo. **b** Case study location from Heliopolis neighborhood and main surrounding streets. *Source* Adopted by the researcher using Google maps, 2017

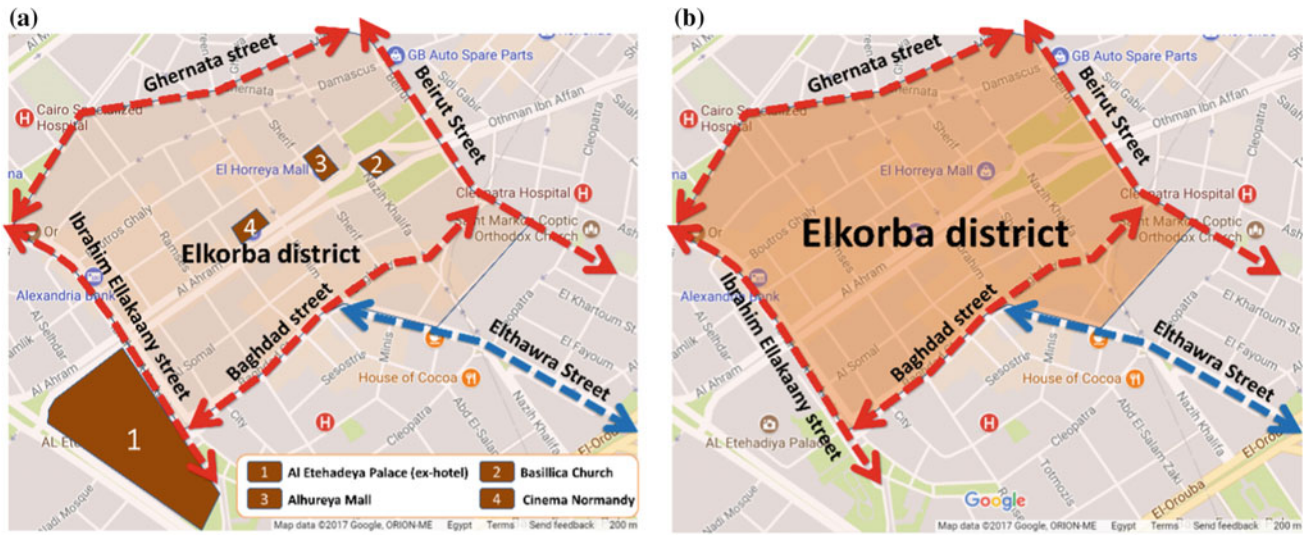


Fig. 2 **a** Main landmarks in the study area. **b** The study area of Heliopolis. *Source* Adopted by the researcher using Google maps, 2017

gentrification indicators developed by Kennedy and Leonard (April 2001). Meanwhile, to propose possibilities for degentrification process as well, which will be more illustrated in further researches due to the specific focus of the current research.

The study population included some interviews with governmental bodies such as the Heliopolis for Housing and Development, National Organization for Urban Harmony and the local authority as many projects were supervised by such bodies. Heliopolis Heritage which is a non-governmental organization is interested to conserve Heliopolis heritage. And as renting—renting refers to the rent gap which plays a very important role in the gentrification process—some interviews were done with renters and owners as well, also some residents were interviewed, regardless to which social group they belong to, as it was determined that the residents belong to the same social group with the same race, as race is not an issue in the study area with some exceptions of Syrians, Armenians, Greek and Italians who are still living in Heliopolis, who belong to the same race but with different background, culture and traditions. Also, some tourists and passing-by users were interviewed and the table below shows the study population, methods and sampling techniques which were used during the study.

4.2 Interviews Analysis

According to the interviews, the interviewees seemed to be open and welcoming to discuss the study area, this due to the openness and exposure of the neighborhood to visitors and

residents who belong to different backgrounds. The replies of residents to questions related to buildings which have architectural values and had been sabotaged were worried and panicky sometimes. The interviewees seemed to be conservative toward some social behavior of visitors who tend to misuse the calm environment that Heliopolis used to enjoy, which has nowadays changed to noisy, harshness and sometimes vulgarity.

Tenants and residents answered most of the interview questions, they contributed with kindness and eagerness, mainly comparing how Heliopolis used to be in the last 20 years and how it is nowadays, crowded with a big economic, social and physical shift. Their memory is always related to the best moments of everyday practice, starting from having breakfast or coffee in a calm café at the corner of their apartments till returning home by the end of the day with much positive energy to start the next day. Mention was made of the change in social strata and behavior of some residents due to the new classes in place of their previous neighbors. One interviewee who is also an expert in architecture mentioned that Heliopolis witnessed a process of "Ruralization" which he defined as the migration of people from the rural areas to Heliopolis especially the poorest zone of Ezbet El Moslemen. Ezbet El Moslemen considered to be the working-class neighborhood which was designed in the beginning of the twentieth century to accommodate the working class next to the residential areas of the middle- and upper-middle-class families, in a comprehensive integrated community context. This context was one of the most successful policies used in Heliopolis. Some tenants claimed that the prices had doubled within the last year as it is important to mention the devaluation of the Egyptian currency relation to foreign currency which was accompanied by increase in prices of all goods and properties. While regarding educational level and awareness, the interviewees argued that most of the residents have high educational level with bachelor degrees, but on the other hand, people who are working have lower level of education such as diploma or high school education only.

The manager of the Heliopolis for Housing and Development argued that Heliopolis is very unique in its architectural style and values, but the most important challenges which Heliopolis is facing nowadays are the demolition and sabotaging of those buildings at night, which is a big loss to the whole neighborhood. This issue was mentioned also by some of the interviewees, by mentioning some examples of villas demolished in their street or next to their home. Another challenge which maybe follows from the lack of awareness of some renters toward the heritage of Heliopolis and how to conserve it for next generations.

An urban expert who is working with the National Organization for Urban Harmony as an external evaluator for urban harmony dealt with many cases of buildings which were under the Heliopolis monument list of the ministry of antiquities. He declared that the profit of real estate development is very beneficial for contractors who are the main tool of demolishing, which consequently benefits the owners who will get much profit from demolishing a small villa with 6–10 apartments in average with access to garden and raise another 10-story building with 60–80 apartments in average with no garden. Thus, it may reflect the richness of the newcomers (gentrifiers) who mostly consist of young families or newly married couples. As Heliopolis gentrifiers have a high level of education and are relatively considered to belong to higher middle class, they tend to work one main job to cover life expenses, most of them are working as

Fig. 3 Buildings with unique and valuable architectural style. *Source* National organization of urban harmony, according to law 144 for 2006

managers; shop, company, restaurant, cafe owners; and experts who tend to live in Heliopolis as a social interface, especially El Korba district and Baghdad street. The social interface was also mentioned and assured by many interviewees to be an important issue for newcomers as they look for social interface which will increase their chances to belong to the higher middle class.

As much as residents enjoy the new urban life, they suffer from the increase in rents and running costs. Many residents who had endless renting contracts tend not to do any kind of maintenance to their apartments because they are not the real owner of it. This accordingly leads to the deterioration of the buildings, which exposes them to demolition regardless of their rich architectural style. Thereby to replace residents by other newcomers who, eventually, will accept to pay higher rents to enjoy social, cultural and economic satisfaction due to the proximity to urban facilities, this emphasizes the main concept of displacement. While in correspondence to the increase of land prices, landowners tend to construct new buildings without any respect to the surrounding urban context and harmony, thus many inconvenient buildings have appeared in the last decade, with irrelevant architectural style compared to the Heliopolis context. With increased land and renting prices for the renovated buildings, old residents who enjoy living with the old rental law showed no care toward any hopes for renovating any buildings, thus producing low housing values in some areas. On the other hand, the owners suffer from low rents due to the old rental law as the living standards increase, price of renovating increases (Fig. 3).

4.3 Map Analysis Results

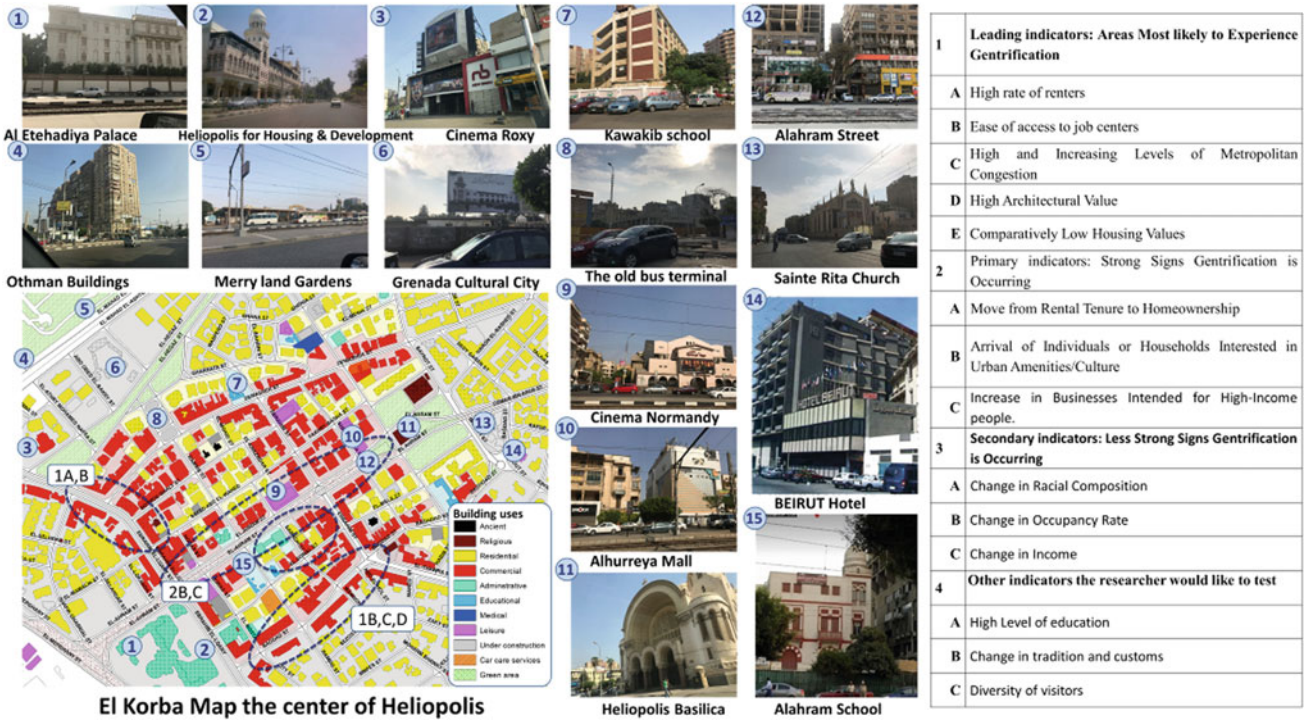
By overlapping the uses, heights and conditions of buildings in El Korba district, it was found that the locations of commercial activities mostly are concentrated in monumental buildings, which were used previously for commercial activities as well, while the adjacent buildings to monumental buildings had changed their uses to commercial, and services to be consistent with the increasing need for commercial activities, as shown in Fig. 4, which reflects the strong appearance of gentrification leading indicators. While the main problem is the modernization of commercial activities which sometimes get over the monumental features of the monumental buildings especially by sabotaging the facades to hang the shops' new signs, vacant lands and buildings under construction are a very promising opportunity to increase ownership percentage, for newly built modernized buildings. The existence of administrative buildings is significant as well, banks, the presidential palace, headquarters of national and international companies, which increase the opportunity for job seekers to apply for jobs in the district. Cafes and trendy restaurants on the main spines of the district have driven the district toward a higher rate of rents with more pressure on urban facilities and infrastructure. The district uses vary from residential, commercial, administrative (office buildings), to educational, leisure, religious and medical activities, with also significant percentage of green areas. This assures the diversity of the district to attract many different visitors to use, entertain, live and shop in the same area.

However, most of the buildings have a good physical condition, especially the monumental buildings, which reflects the awareness toward the monumental buildings and the high educational level the residents have in the district. While the bad-condition buildings, with low housing values have two floors which soon will be changed to a newly high-rise building as shown in Fig. 5. Generally, bad-condition buildings are good opportunities for future gentrification, as these buildings are in a passive state. As soon as the neighboring building started to be renovated or used, the passive building becomes active and more motivated for reuse or renovation.

Meanwhile, the district has many headquarters for international companies, which are in relatively new modern 10-floor buildings. Also, high-architectural-value monumental buildings built from stones and bricks, and characterized by low height (between one and four floors) are very significant especially in Al Ahram, Ebrahim Elqany and Baghdad streets as shown in Fig. 5. So far, the change in income, as low buildings stand next to high buildings and reinforced concrete buildings next to stone and brick monumental buildings. Thus, the following examination was made to assess the gentrification indicators in the historic city of Cairo and shown below the results of this examination.

From the table above, the researcher concluded that the case study identifies strong leading, primary and secondary indicators of gentrification, which means that many precautions had to be taken into consideration when dealing with this neighborhood for future upgrading and development plans. Meanwhile, it turns out that there are some other indicators that must be considered: first is high level of education, as it indicates the level of awareness and behavior dealing with heritage and architectural values. Second is change in tradition and customs, as people tend to live beside religious buildings that the neighborhood has, seeking blessing to make them closer to god. The final one is diversity of visitors, as this will show whether the district is well known by them, so people tend to hang out there or not; which means more powerful gentrification toward Heliopolis.

The satellite images by Google Earth comparing two different periods of urban transformation in Heliopolis show the construction of new buildings and the demolition of others, adding to the loss of green areas due to the current



1	**Leading indicators: Areas Most likely to Experience Gentrification**
A	High rate of renters
B	Ease of access to job centers
C	High and Increasing Levels of Metropolitan Congestion
D	High Architectural Value
E	Comparatively Low Housing Values
2	Primary indicators: Strong Signs Gentrification is Occurring
A	Move from Rental Tenure to Homeownership
B	Arrival of Individuals or Households Interested in Urban Amenities/Culture
C	Increase in Businesses Intended for High-Income people.
3	**Secondary indicators: Less Strong Signs Gentrification is Occurring**
A	Change in Racial Composition
B	Change in Occupancy Rate
C	Change in Income
4	**Other indicators the researcher would like to test**
A	High Level of education
B	Change in tradition and customs
C	Diversity of visitors

Fig. 4 Ground floor land use of buildings of the case study—El Korba district—with landmark photographs and gentrification indicators. *Source* Central agency for public mobilization and statistics and adapted by the researcher using GIS

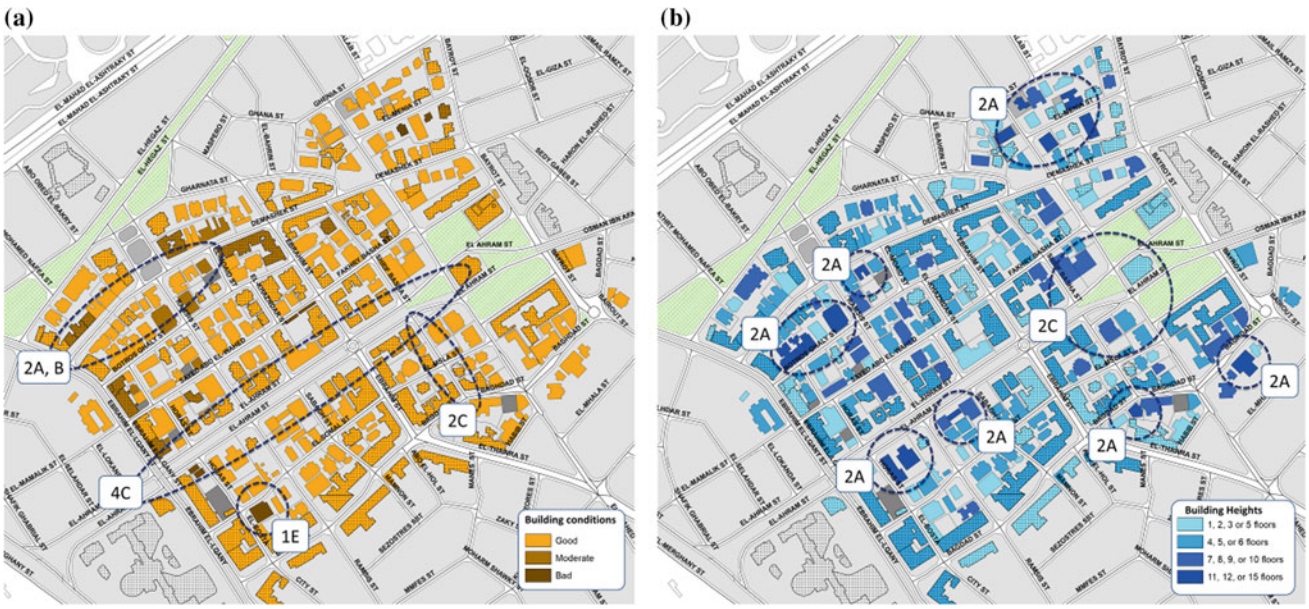


Fig. 5 **a** Conditions of buildings; **b** heights of buildings of the case study—El Korba district—gentrification indicators. *Source* Central agency for public mobilization and statistics and adapted by the researcher using GIS

urban regeneration projects. Accordingly, gentrification is developing in Heliopolis in general and in El Korba district, particularly, as shown in Figs. 6 and 7. The examination of gentrification indicators' outcomes answered some doubts whether Heliopolis is exposed to gentrification or not, as shown above; while concerning leading indicators, the analysis result was YES to all leading indicators except for the indicator of "comparatively low housing value" because

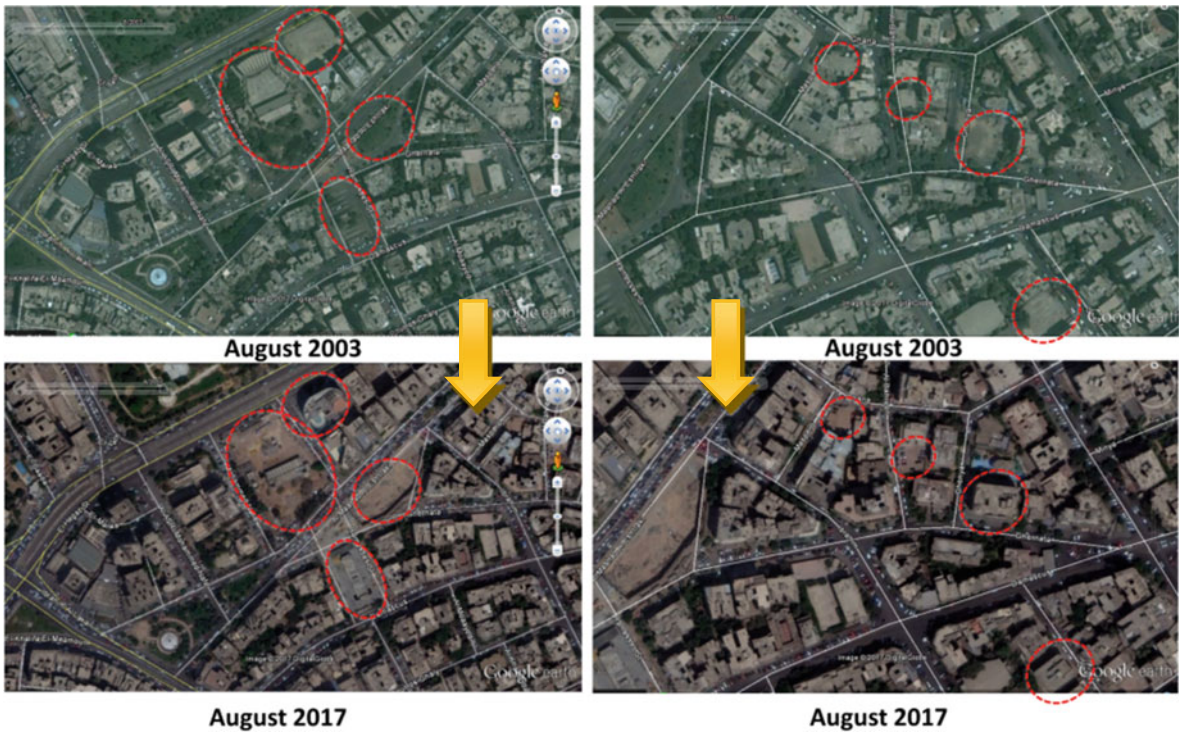


Fig. 6 Urban transformation for buildings which had been demolished or newly built on vacant lands. *Source* Google Earth maps, historical imaginary, satellite images on August 2003 and August 2017

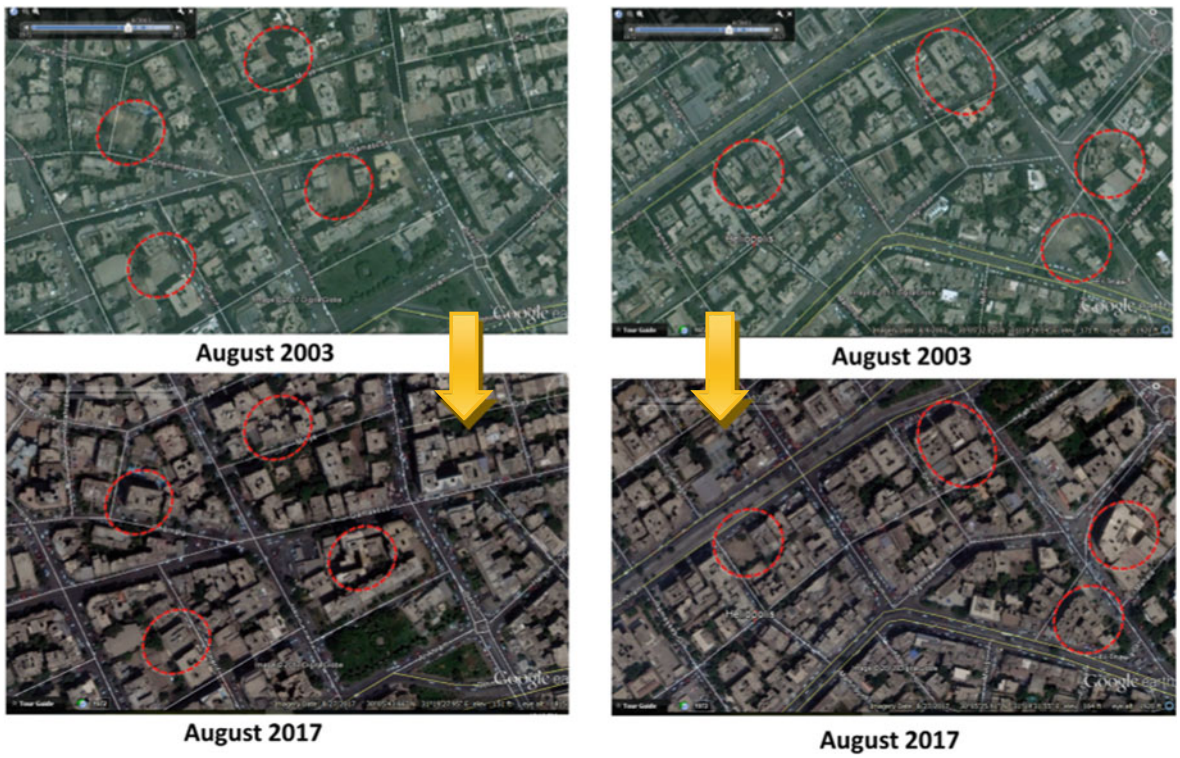


Fig. 7 Urban transformation for buildings which had been demolished or newly built on vacant lands. *Source* Google Earth maps, historical imaginary, satellite images on August 2003 and August 2017

Heliopolis is witnessing a shift nowadays as most of the buildings are even been renewed or demolished and new building replaced the old ones, or some revitalization and regeneration projects are taking place. Thus, there is not a clear evidence for low housing value in the neighborhood. Accordingly, Heliopolis is highly exposed to gentrification process. This area enjoys very high architectural values back to the beginning of the twentieth century, unique architectural style and monumental buildings.

On the one hand, the neighborhood has a comparatively high rate of renters, especially on the Ground floor land use, due to the commercial activity nature which needs many facilities such as storage areas, showrooms and stores. So far the area is considered to be a vital and essential access to job centers as it is located in one of the new nuclei of the eastern part of Cairo.

On the other hand, concerning primary indicators, the analysis result was YES as well to all indicators. As mentioned before, the city is a visiting attraction for many Egyptians; households tend to change the use of their buildings to urban amenities to facilitate and attract visitors, such as hotels, restaurants, clothes and cafes. While concerning secondary indicators, the analysis result was YES for both change in occupancy rates and change in income, and it was YES to the change in racial composition due to a relatively significant number of old residents with Greek, Armenian, Italian backgrounds and recently Syrians, also migrants from many Egyptian villages. All together have different cultures and traditions with culture, traditions and habits.

5 Conclusion

According to the map analysis and examination of gentrification indicators used in the case study of Heliopolis in Cairo, it was found that Heliopolis is highly exposed to a gentrification process which needs more study to get to know how gentrification will evolve soon, especially with recent activities and actions the area may face after the urban regeneration and revitalization projects which took place in the last 10 years. It is crucial to mention that gentrification is a recent discipline which performed by the 1980s, as gentrification process is under examination and exploration as more and more needs to be discovered, especially in Egypt, which is a virgin land to examine the gentrification process.

It has been evident that the case study needs more research using demographic analysis to monitor the demographic shifts in the last decades to clarify the changes in social structure.

In other words, who moves where, when and how in such neighborhood. Accordingly, more analysis is needed to identify the different causes for gentrification and types of gentrifiers, as the case study touched upon and dealt with some of them as newcomers during the interviews and survey. While the replaced new buildings wave is significant, they increase in quantity but lack the architectural and social interaction qualities. Also, a detailed economic analysis, income rates, tax payments, as well as sociocultural analysis, are needed.

The survey, exploration and examination of fieldwork primary data showed that the examined indicators, which were modified by Kennedy, missed some factors related to culture and traditions. These indicators should be taken into consideration, as the researcher tried to conclude and examine some of these indicators during the case studies, as level of education, diversity of visitors, but they are still under development. Geographic Information System facilitates the exporting of maps, which is a tool for analysis and to deduce gentrification locations considered being useful and fruitful, and more are to be expected from the analysis tools it has; also the comparison of historical Google Earth maps was an indication of physical transformation in Heliopolis.

Finally, as gentrification considered before being a haphazard process in some cases, it could be managed and controlled for the benefits of the inhabitants by this will overcome and decrease the negative consequences of gentrification and maximize the benefiting of its positive consequences. Beside gentrification's positive consequences, it lacks quality considering conservation and cultural differences. If gentrification is to happen, it must go hand in hand with conservation in order to conserve the historical buildings.

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Technology and Architectural Heritage: Dynamic Connections

Maria Luisa Germanà

Abstract

Technological aspects strongly characterise the built environment in both material and immaterial dimensions. The architectural heritage (the built environment that has acquired cultural meanings, without prejudice regarding the age and the scale of observation) offers a peculiar point of view for dealing with this issue. This paper outlines the dynamic connections between technology, the whole idea of architectural heritage and the approaches to intervention. A focus is placed on four main theoretical aspects, the effects of which are also significant on the practical field: the distance from contemporaneity; the concept of Time; reliable conservation; sustainability. The technological evolution that has had such an effect on the architectural heritage is briefly outlined, starting from the First Industrial Revolution and concluding with digitalisation, which is now imposing a profound rethinking regarding both technology and heritage. From such considerations, it might be possible to derive a paradigm, to be discussed and shared, aimed at piloting the conservation of the architectural heritage in the forthcoming years.

Keywords

Architectural heritage • Technology • Concept of Time • Reliable conservation • Sustainable conservation • Digital technologies and heritage

1 The Connections Between Technology and *Architectural Heritage*

The expression *architectural heritage*, codified in Europe to indicate the built environment *of conspicuous historical, archaeological, artistic, scientific, social or technical interest* (CoE 1985), albeit deeply rooted in the origins of Western culture, has by now attained a global value (Jokilehto 1986, 2007) and concerns a wide range of examples without reference to the age and scale of observation. The need for conservation is closely linked to the architectural heritage, as evidenced by the word *heritage* itself, which indicates something to be preserved for posterity. The meaning of conservation has evolved in both its quantitative and qualitative aspects; in fact, conservation has extended its field of application, initially covering single historical buildings and gradually incorporating the surroundings of these buildings, urban and rural settlements, and historical centres and landscapes. Immaterial features of conservation have also emerged more recently; for instance, the integration of conservation with urban and regional planning (ICOMOS 1975) and the value of the cultural heritage for society (CoE 2005) now represent firmly established concepts. Lastly, conservation is currently seen as one side of the same coin, as enhancement of the architectural heritage; these are no longer seen as rivals, but as sharing a concurrent goal.

Over the last 20 years, research experiences in the Department of Architecture of the University of Palermo have provided the opportunity to apply a technological approach to the conservation of the architectural heritage and archaeological sites, demonstrating the need for concepts such as *process*, *system*, *reliability* in this particular field of application (Germanà 2014a). These experiences form the basis of subsequent considerations regarding the relationships between technological evolution and progressive change in both the practice and theory of conservation of the architectural heritage. The whole idea of the architectural heritage has had strong connections with technological

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culture ever since its origins. In the last three centuries, these connections have grown and have reflected the radical transformations in the technological processes that have taken place in this period. The paper proposes a critical summary of the changes occurring thus far, aiming to rethink the basis of these dynamic connections, to enhance their potentialities and to confront any eventual hazards.

2 The Distance from Contemporaneity

The concept of *monumentum* has existed since ancient times to indicate an object or a building, not necessarily old, devoted to perpetuating a memory. During the period between the late eighteenth and early nineteenth centuries, many artistic and philosophical trends, following the cultural revolution of the Enlightenment, broadened the meaning of this concept, contributing to the formation of the current idea of *Heritage*: the significance of *a marker of the past* was added to the role of witness to something memorable, thanks to the *qualities of commemoration, visibility and durability* (Meyers 2012, p. 8) (Fig. 1).

While acknowledging several contributory factors to the origin of the concept of *Heritage*, in the case of architectural heritage the main interpretation should be pinpointed in technological evolution, marked in this period by the landmark of the *First Industrial Revolution*. The profound transformation of manufacturing processes and the consequent availability of new materials (or those featuring higher technical performance) have led to discontinuity in traditional building techniques. Other effects aside, this discontinuity has formed the basis for contemporary architecture, influencing relationships with the built environment, which became obsolete within a few generations. In this framework, there has gradually emerged a cultural distancing from existing buildings (evident both in the technological aspects of the productive process and in the dimensional and aesthetical features of the new buildings) (Fig. 2).

A study of Italian architectural culture between the two world wars, mainly based on a direct reading of specialised journals published in Italy (Germanà 2005b, par. 1.3.1), highlighted the fact that the progressive and quite arduous enhancement of modernist architecture in this country has produced a clear evolution in design approaches to existing buildings. Before the spread of modernism, a mimetic approach connoted interventions on existing constructions; the aim, to guarantee total morphological coherence, was feasible, thanks to technical continuity. There appeared a tendency, around 1930, towards superimposing the new architectural style on existing buildings, but this did not necessarily have any connection with the introduction of new materials or techniques; the prevailing justification in this case was intolerance towards the old features and a search for aesthetical appropriateness to the contemporary. During the following decade, functional and structural inadequacy began to justify many transformation processes on existing buildings. The main aims were, on the one hand, to acquire indoor space where a new lifestyle might be comfortably

Fig. 1 Telamon of the Zeus temple in Agrigento. Photograph by G. Pitrone, 1926, Ente Parco Archeologico Agrigento

Fig. 2 Traditional buildings seen from the roof of BIGyard, built in 2010 in Berlin (Zanderroth Architect; www.zanderroth.de)

accommodated and, on the other, to guarantee safety, which traditional structures gave the impression of never having had (piloting a pernicious trend that would later cause so much damage in interventions on ancient buildings).

While the so-called *Second Industrial Revolution* was reinforcing and increasing the effects of the transformations in the previously triggered productive processes, the distance of contemporary architecture from pre-industrial buildings was increasing. At the same time and similarly, in that historic scenario, the architectural heritage was being dissipated, entering into an ever more delimited dimension, a niche, within which only a selected few could be absorbed. The separation of the architectural heritage from the ordinary sphere is seen very clearly in two principal aspects, becoming a constant for the entire twentieth century: the belief that only cultured people are capable of understanding the architectural heritage and the hyper-specialisation of the technical and architectural competences required to design or administer it.

3 The Concept of Time Between Linear and Cyclical Vision

The massification of the industrial productive model (enhanced during the *Second Industrial Revolution*) has breached the traditional Western concept of Time, locating the Past in an extraneous dimension, almost always in an unequivocal contrast with the Present. The distance from the Past had been expressed centuries before, during the Renaissance, but the approach to historical remains was very different, because ancient architecture was felt to constitute the deep cultural roots of contemporary architecture and, for this reason, was experienced, within a sort of technical continuity, regardless of morphological and spatial evolutions. The clearest difference in this comparison can be seen in those vestiges of the Past that could not be reproduced after the nineteenth century, precisely as a result of the discontinuity in traditional technological processes. From this, there has arisen the need for ever more rigorous conservation of the material substance of the built heritage.

The role of the concept of Time in the approach to the architectural heritage and its conservation has been outlined in research into the artistic and technological contamination between Eastern and Western cultures (Germanà 2013, p. 113). The differences in the diverse concepts of Time in the built heritage have been demonstrated by comparing two edifices; both religious buildings built out of wood (Fig. 3).

One of the main reasons for interest in the Norwegian *stave churches* is the authenticity of the building material; most of the wooden elements are a part of the original construction dating back centuries. For the sake of preservation, ordinary church functions have been transferred to other, newer premises, while the old church buildings have been crystallised in the singular role of *monumentum*. In contrast, the Japanese Shinto shrines in Ise are rebuilt every

Fig. 3 On the left, Borgund Stave Church, Norway, built between 1180 and 1250 A.C. (Wikipedia Commons). On the right, the old and the new shrine of Ise, Japan, *immediately prior to the Sun goddess's progress of 2 October 2013* (http://www.japansociety.org.uk/)

20 years on an adjacent site. The building process features precise and ritual phases, beginning with the cultivation of the trees (their position during growth, and after cutting back, will reflect the orientation of the ensuing building element). The temporary nature of these buildings does not provide any excuse for their precariousness; due to its longevity, the Japanese cypress *hinoki* is used for the structure (Howells 1995, p. 10). The procedural preparation of the tools used to cut and to finish the wooden elements is very long and nothing is left to chance. The traditional *yariganna*, a spear used in ancient times to obtain smooth and waterproof wooden surfaces, was reproduced in a recent rebuilding intervention, to increase durability (Howells 1995, p. 11). Last but not least, especially in comparison with the present-day fall into disuse of the medieval Norwegian churches, the Shinto shrines cannot be regarded as vacant; the cyclical relocation, made possible by the ritualised vicennial rebuilding, assures the goddess's continuing presence.

The juxtaposition of authenticity and replica has spiced up a heated debate in the architectural conservation field (ICOMOS 1994; Weiler and Gutschow 2017); its meanings change more than a little in the light of the different concepts of Time. As a consequence of the linear concept of Time, every epoch lays down vestiges upon previous layers; this stratification gives substance to the heritage, in which cultural interests are recognised precisely because they are extraneous to the contemporary, as the beginnings of the culture of architectural conservation have shown (Riegl 1903, p. 52). The distance from contemporaneity makes sense only in accordance with linear Time: the Past does not belong to the current reality, which does not have the tools to reproduce it without falsification. The complete separation between Past and Present is in conflict with the circular concept of Time prevailing in Eastern culture, where material authenticity does not matter, because the cyclical repetition of the processes is enough to guarantee a satisfactory result. Cyclical Time renders the Past ongoing in a continuous Present, because attention is focused on the process and not on the product. This suggests a possibility for rethinking conservation; most interventions need technical continuity rather than innovative solutions, which inevitably end up as transformative and clash with the physiological nature of maintenance (Marconi 1984).

4 The *Imperative of Responsibility* and Reliable Conservation

Radical rethinking on technology guided the search for new paradigms during the last decades of the twentieth century. The evidence of the uncontrollable effects of most new technologies (Jonas 1979) encouraged the search for a different model of growth, more qualitative than quantitative. The spread of automated production as a consequence of the *Third Industrial Revolution* (Rifkin 2011) has veered towards even more quality-oriented, flexible and mass-customised, *lean production*. This further, profound technological evolution is also gradually changing the cultural and operational approach to the architectural heritage, highlighting reliability as one of the main criteria.

Fig. 4 Soluntum (Hellenistic archaeological site on the northern coast of Sicily, near Palermo). *Casa delle Ghirlande* in 1999 (on the left) and in 2015 (on the right). Photograph by M.L.G

The aim of reliability in the conservation processes has emerged as a reaction to the numerous critical conditions, which perpetuate emergencies in the architectural heritage field. There has been a focus on reliable conservation with regard to two different, but interrelated, dimensions: *material reliability*, referring to the permanence of the conservation results, and *immaterial reliability*, referring to the overall quality of the conservation processes (Germanà 2003). The first dimension helps us to tackle (and to avoid in any future interventions) the failure of certain technical and material solutions adopted in restoring the built heritage during the twentieth century (such as reinforced concrete or cement mortar) (Fig. 4).

The second dimension, highlighting the sequence of decisional, executive and management phases in the interventions, is aimed at rendering more practically pursuable conservation objective, outlining the need to assess the requisite skills, operational tools, costs and procedures. In any case, reliable conservation is closely linked to the *precautionary principle*, the need for which was derived from the ethical rethinking of technological culture in the last quarter of the twentieth century. In fact, it is based on a long-term view and on an awareness of the risks inherent in any operation and in any lack of intervention (Fig. 5).

A connection can be observed between reliability and the above-mentioned concept of Time. In fact, the unity of Past, Present and Future, typical of the cyclical vision, is coherent with the quality-oriented productive processes and with the *kaizen*, a Japanese word introduced into the field of technology to indicate continuous improvement, to be achieved by small incremental advances towards greater efficiency and by a contribution from all the operators involved. The process-based view is also essential in the conservation of the architectural heritage; in a framework where knowledge, conservation and enhancement are concurrent objectives, a unified and systemic approach makes possible the organisation of the activities in sequences, in which necessary skills, operational tools, procedures and resources are clearly identified (Germanà 2014b). In addition, whereas, within the linear vision of Time, the Present is merely a sort of parenthetical phase (between the original time of the Past and the beneficiary time of the Future), the cyclical vision confers centrality to the Present, as the only moment in which attempts at conservation can achieve anything of consequence (Fig. 6).

5 Dual Sustainability of the Architectural Heritage[1]

Every productive process is currently always compared with the goal of sustainability, which includes many multifaceted and integrated aspects of quality with its three dimensions (social, economic and environmental). The progressive definition of this theme is consistent with the most recent developments in technological culture, as highlighted by two principal aspects: the growth of awareness of the limits of natural resources (Meadows et al. 1972) and the belief in the birth of *Anthropocene*, a new epoch triggered by the irreversible consequences of scientific and technological progress on our planet (Hamilton et al. 2015).

[1]The Author presented the contents of this paragraph as a part of the paper *The Dual Sustainability of Architectural Heritage: Environmental Aspects*, presented at the International Conference *Green Conservation of Cultural Heritage*, held in Palermo in November 2017.

Fig. 5 Gela (archaeological site on the south coast of Sicily). Evidence of the subsequent conservational interventions on the earthen urban walls of Capo Soprano. Photograph by M.L.G. 2015

Fig. 6 *Prudenza* (Prudence) by Cesare Ripa can be read as a metaphor for the cyclical vision of Time (C. Ripa, 1603, *Iconologia overo Descrittione di diverse Imagini cavate dall'antichità et di propria inventione*, p. 416, available at www.bivio.filosofia.it). In fact, the Prudence is represented as two-faced (one face towards the Past and one towards the Future). But a third face, in the mirror's reflection, seems to suggest an implicit centrality of the Present

Generally speaking, the role of the built environment in achieving sustainability is well known, especially regarding the reduction of energy consumption, both in the building phase and, even more so, in the utilisation phase; EU countries are sharing the ambitious goal of having all new buildings consuming *nearly zero-energy* by 2020 (EU 2010). The architectural heritage too is involved with sustainability, a globally shared necessity that has prompted further interest in the generally acknowledged areas of the traditional built environment (historical, archaeological, artistic, scientific, social or technical).

On the one hand, many examples of built heritage suggest a sort of precursory sustainability, because of some of their intrinsic technical features: the sensible use of materials, preferably available in situ; the natural tendency towards the recycling of entire buildings, constructive elements or materials; the application of passive solutions for the heating and cooling of spaces; the search for appropriateness in relationships with the surroundings, taking into account the main natural elements, such as the sun path, the prevailing winds and overall orientation. The architectural heritage might proudly proffer itself as an example of sustainable built environment, capable of providing useful indications for contemporary architecture (VERSUS 2014). Such features in traditional buildings are not casual. As research into Sicilian rural architecture has shown, precursory sustainability has also been recognisable in theoretical developments, ever since Vitruvio's *De Architectura* and right up to manuals dealing with the rural architecture of the nineteenth century (Germanà 2005a).

On the other hand, interventions in the architectural heritage also need to bear sustainability in mind. Referring to the sociocultural and economical dimensions of sustainability, many examples of best practices have shown that, if correctly oriented and promptly and effectively managed,

conservation processes play an important role in enhancing local communities, with relevant economic benefits and enrichment of the cultural identity (see, for instance, the activities of the *International Centre for the Study of Herculaneum*, reported in www.herculaneumcentre.org). With reference to the environmental aspects of sustainability, on the subject of cleaning treatments, protection and conservation, the impact on the environment of the products used, as well as on the built heritage and on the safety of the operators, should be carefully considered. In addition, preliminary knowledge of the environmental context is an indispensable condition for sustainable interventions, in order to avoid misunderstanding the bioclimatic features of the surroundings and of the building itself.

A bioclimatic study of the Hellenistic archaeological site of Soluntum, on the northern coast of Sicily, near Palermo, has added to available knowledge, by underlining the wisdom of the original choice of the place. In fact, the ancient city is well oriented to guarantee maximum solar gain; the nearby mountains do not project shadows upon it, even on the darkest day of the year (Fig. 7). Analysis of the state of conservation of the architectural heritage is carried out thoroughly, especially when also taking into account the environmental aspects of the surroundings; for instance, it is well known that solar radiation influences biodeterioration phenomena and winds compound the erosion of stone building materials. However, conservation operations may also benefit from the bioclimatic approach; focusing on the *protective* structures of earthen walls in Soluntum, a low-cost solution has been suggested, incorporating natural ventilation so as to avoid harmful consequences from the greenhouse effect (Fig. 8).

The appropriate importance attached to dual sustainability (both to the architectural heritage itself and to the activities carried out on it, as regards knowledge, conservation and enhancement) might have many positive consequences, not only in reducing the environmental impact but also in contributing to the above-mentioned reliable conservation, especially with reference to the durability of the technical solutions chosen for conserving the architectural heritage.

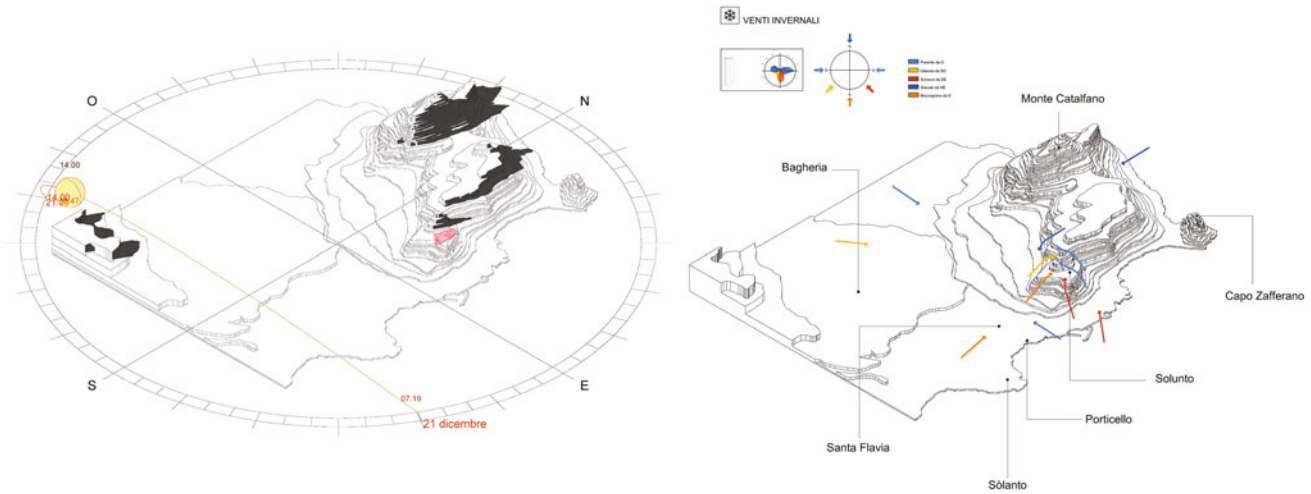

Fig. 7 Soluntum. On the left, general view at 2 p.m. at the winter solstice. On the right, part of the study of the prevailing winter winds (Germanà 2016a, p. 99)

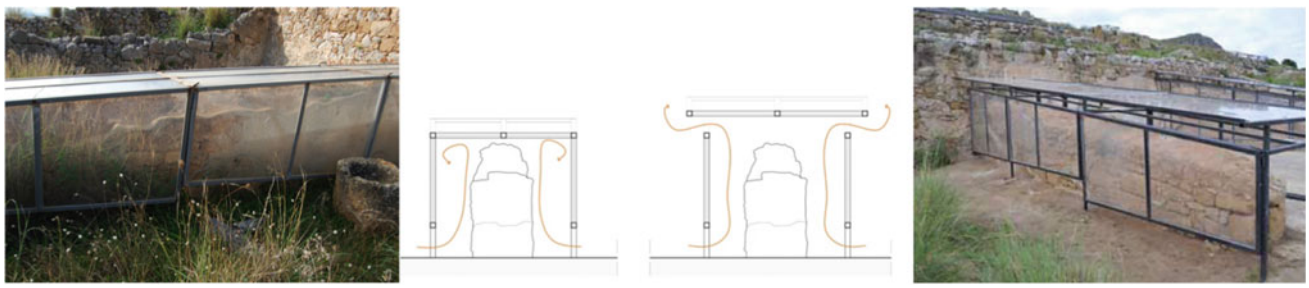

Fig. 8 Soluntum. A detail of the protective structures on the earthen walls. On the left, the situation in November 2014 (Photograph by M.L. G.). In the middle, the bioclimatic low-cost solution proposed. On the left, the situation in 2016 (Photograph by Bordonaro, Spatafora, in Cilia, E., and Not R. (eds.) (2016), *Conservare è Tramanadare. Tecniche innovative per pavimentazioni antiche e strutture in terra cruda: una sfida ben consolidata*, Centro Regionale Restauro Regione Siciliana, p. 62)

6 Digital Technology and Architectural Heritage: The Operational Transformations

The most recent and increasingly rapid technological evolutions are centred on digitalisation and include a variety of innovations, brought together by the so-called *Fourth Industrial Revolution*, which in some opinions can be read as the continuation of the *Third* one, in others as a new trend, made possible by the unprecedented advances of scientific knowledge, the practical applications of which are distinguished by *velocity, scope, and system* and announce *the transformation of entire systems of production, management, and governance* (Schwab 2015). Through conversion into digits, the technological processes seem to have achieved the maximum in dematerialisation. This phenomenon involves an increasing number of people: in fact since 30 June 2017 more than half of the world's population is an *Internet User* (www.internetworldstats.com). In addition, mobile devices have increased the opportunities for digital connection, liberating it from a specific place, characterised by what is a consequently specific material reality.

In a very few years, digital technology and the Internet have brought about several practical and operational transformations in the field of architectural heritage, the consequences of which are already evident and which will probably increase in the short term, thanks to a reduction in costs of devices and their ever-higher user-friendliness. In fact, many digital devices are currently being used in diverse activities carried out on the built heritage. These operational transformations form a composite framework that is continuously and rapidly evolving (Table 1).

Digital devices applied to knowledge processes are geared towards very specific operations, and their applications demand highly specialised expertise and extensive technical skills, even though the procedures are usually relatively quick and inexpensive. Regarding the dimensional surveys, devices such as digital cameras, laser distance measurers, laser scanners and drones have made precise and detailed dimensional results possible, also without any direct contact with the built objects to be captured. Thanks to digital surveys, an impressive amount of data can be collected, elaborated, stored and shared globally, rendering the dream of an entire global catalogue of the architectural heritage feasible. Regarding diagnostics, many digital devices or digital components belong to the toolkit of in situ, non-destructive analyses (such as thermographic cameras, ultrasonic devices and endoscopes) (Bianco 2017), and make it easier to understand the structural damage and transformations that have taken place over time, the traces of which are recognisable in the architectural palimpsest.

Digital technology applied to surveys and analysis is certainly an important facilitator of knowledge, and, consequently, of the conservation of the architectural heritage. However, as these innovations are not miraculous, they cannot resolve certain critical conditions (Germanà 2014b) that remain in the process, both upstream and downstream. How to tackle the planning of the surveys and analysis (bearing in mind the status quo, the objectives of the intervention and the available financial and technical resources)? How to guarantee access to knowledge and how to deal with data obsolescence? This last problem is particularly urgent today; in addition to the usual need for updating information regarding the architectural heritage and

Table 1 Digital devices used in architectural heritage field: a partial summary

Examples of devices	Main applications	Critical aspects
Specific devices: – Laser scanner; – Digital cameras; – Thermographic cameras; – Ultrasonic devices; – Endoscopes	Knowledge processes: – Surveys; – Monitoring; – Diagnostics	Highly specialised expertise Extensive technical skills Activities planning Interoperability Data accessibility Data obsolescence
Generic devices: – 3D printer	Conservation processes: – Reproduction of missing parts	Activities planning Interoperability Customisation
Generic devices: – Personal computers; – Smartphones; – Tablet; – Displays; – Touch screen	Enhancement and divulgation processes: – Basis for virtual reconstruction and for sharing cultural experiences	Activities planning Interoperability Loss of the connection with the specific place Loss of identity Lack of accuracy of the contents

its contextual conditions, digital data very soon become unreadable due to the obsolescence of the format in question.

Many well-known examples regarding the cultural heritage demonstrate the increasing diffusion of other digital devices that are not actually characterised by a specific applicative field. Most of these devices, which are pervasive in many other aspects of daily life, have also changed the way of dealing with conservation and the fruition of architectural heritage.

With regard to interventions on the material elements in the built heritage, 3D printing has been adopted in reproducing missing parts of mouldings and other details, on the basis of 3D models obtained by laser scanner surveys (Fig. 9). Also in this case, digitalisation involves only the operational, and not the decision-making aspects of interventions. It is foreseeable that 3D printing will become more widespread in the field of heritage, not just for producing gadgets and reproductions but also for supporting both the off-site and the on-site productions of the building materials to be used in refurbishing, as is already happening in the building sector (Codarini et al. 2017). The customisation of design solutions and self-build practices may nowadays sound rather strange for architectural heritage, especially considering the public dimension of its meanings (Germanà 2016b). However, two aspects might reduce this strangeness in the foreseeable future: the diffusion of cultural meanings in *minor* assets, the private dimension of which could be relevant; the ever more active role of the *user*, who in this specific case may be a citizen, a visitor or a person working and living in historical buildings or cities. In the latter case, digital technology will certainly be a key factor.

Finally, the broader impact of digital technology on conservational activities may be individuated in the innovation of processes. In a very few years, BIM has pervaded the architectural, engineering and construction industry especially in the design and construction of new edifices. The representation has surmounted the three-dimensional space, containing information on materials, costs, performances and maintenance needs. The most revolutionary possibility that makes BIM a new paradigm (Takim et al. 2013) is the integration between the phases of design, construction and management, which contributes to solving the sectionalisation of the productive model that prevailed during the twentieth century; this has laid the basis for interoperability, the major consequence of which is overall efficiency. Cutting-edge research is also exploring the potentialities of BIM in the management of existing buildings (*Existing Building Information Modelling*) and of historical buildings *Heritage Building InformationModelling* (HBIM), focusing on the issue of what information is required in order to achieve (and improve) efficient management (Edwards 2017). Even if only niche applications are available as an example, it is foreseeable that the new paradigm of HBIM will soon be a key driver towards the aforementioned reliable conservation.

Last but not least, a wide range of recent examples show the potential of digital technology in the enhancement and propagation of architectural heritage. Digital media consent dynamic and credible representations, very easy to reproduce and share. In the case of incomplete built heritage (mostly, but not only, archaeological built heritage), 3D models offer the basis for virtual reconstructions (both of the buildings and of the ancient relationships with the surroundings), making the ruined vestiges more comprehensible. These representations are suitable for interactive use by every kind of visitor to a cultural place, via digital displays and touch screen tables. Again, via the Internet, one can undergo cultural experiences (heritage included), at any time and in any place, using digital devices such as personal computers, smartphones and tablets, with which one can access every kind of information and service. Finally, digitalisation has opened up previously inconceivable new forms of sharing and enhancing the cultural and architectural heritage: by accessing the Internet and, above all, the social media, local communities are discovering their own heritage, organising bottom-up initiatives centred on collective visits, in which digital devices are used to their utmost potential (see, for instance, the Sicilian experience of *Invasioni*

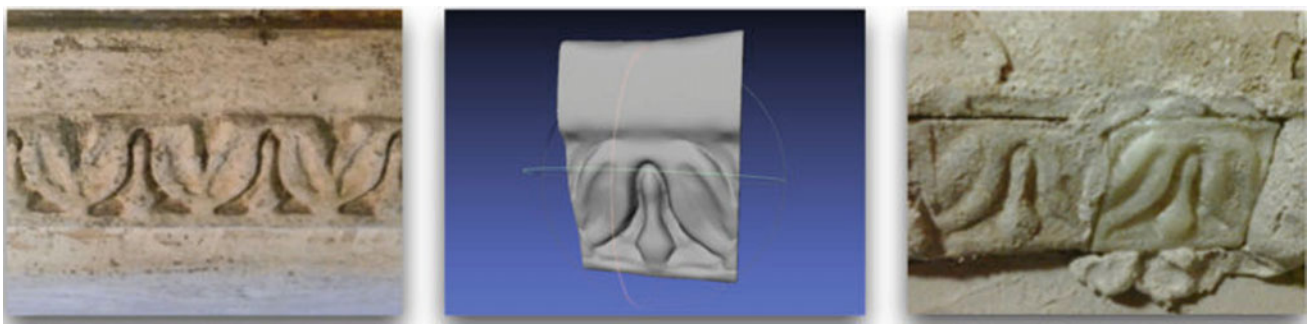

Fig. 9 Moulding in Palazzo Ducale (Mantova): integration of a missing part (laser scanner survey, 3D model and 3D printer) by HeritageLab (http://fablabparma.org/heritage-lab/)

Fig. 10 Digital invasion of Villa Emo by Andrea Palladio (Treviso) in 2016. A treasure hunt was carried out, using digital devices, to find in situ, architectural decorations and paintings (https://www.villaemo.org/single-post/2017/04/25/Le-Invasioni-Digitali-approdano-a-Villa-Emo)

Digitali (Digital Invasion) at http://www.invasionidigitali.it/; Fig. 10).

7 Digital Technology and Architectural Heritage: Evolution of the Process

The consequences for architectural heritage of most recent technological evolutions are better outlined within the framework of their general impact on the ordinary built environment. The building sector, after having initially encountered resistance to change, especially in comparison with other productive fields, has now been overrun by digitisation, which is definitely modifying, on every scale, the way in which we design, transform, manage and use the built environment. For the sake of brevity, only three general aspects, related to the architectural heritage, will be specified as examples: the morphological consequences, the smartness and Internet of Things (IoT) and the search for sensitiveness.

New figurative trends in buildings and in objects, driven by *Computer Architectural Aided Design*, have been the first and most evident consequence for the architectural field in the short term (Riccobono and Pellitteri 2017). The consequent morphological transformation has deepened the aforementioned (par. 2) scar that had cut through pre-industrial architecture after the *First Industrial Revolution*.

Subsequently, *smartness* denoted the built environment (*smart city; smart building*) to indicate a sort of assembly kit of innovations, made possible by the latest technological developments and aimed at improving environmental sustainability. The idea of smart technology has now reached a more mature phase, in which the need for integration between the *users' sphere* and the *experts' sphere*, invoked decades ago by Pacey (1983), has shifted the focus to the human factor. In the case of smart solutions, there is an escalation in the consequences on the effective energy use of individual behaviour (Janda 2011); cultural habits and economic conditions increase in the case of smart solutions, due to the greater incidence of technological appropriacy, also with regard to the generational gap (the *digital natives* approach current technology more easily) and social and economic inequality (*digital divide*). Research on the historical centre of Agrigento has shown the potentialities of smartness as applied to the architectural heritage (Vattano 2013): the hypothesis of a smart reconfiguration of the historical centre creates a link between the material reality and the virtual image; this is drawn from daily experience in a dynamic form, with new kinds of utilisation emerging, thanks to digital technology that enables personalised exploration, in which experiential feedback, shared through the social media, becomes a driving factor (Vattano 2016).

Further theoretical developments on the application of digital technology on the cultural heritage have suggested the idea of *Phygital Heritage*, to observe the seamless blending of physical and digital qualities, especially in heritage communication (Nofal et al. 2017), and the concept of *Internet of Cultural Heritage*, as a specification of the *Internet of Things* (Piccialli 2016); this should negotiate the gap between online and offline experiences, enhancing the physical encounter through digital contents (Petrelli et al. 2016).

A *sensitive* built environment (Ratti and Claudel 2016) represents one of the more interesting possibilities provided by digital technology; some applications (aimed at reducing energy wastage, facilitating an automatic survey of users' needs) have developed a personalised heating, cooling and lighting system which follows occupants as they move around the building, like an individually tailored environmental bubble (Fig. 11). The vision of a *sensitive* built environment includes the issue of emotional and psychological reactions, which can be deduced from facial recognition technology using artificial intelligence; the Venchi edible chocolate pavilion is conceived to be more than a recreational example and it opens up a new frontier, where the indeterminate edge between concern and enthusiasm is very disorienting (Fig. 12). A part of the NEPTIS project, funded in 2015 under PON FESR Sicily 2007–13 Program (co-funded by the European Community) and devoted to information and communication technologies (ICT) in the field of the cultural heritage, is focusing on the integration between the knowledge process and conservation and enhancement processes, based on 3D laser scanner surveys and the 3D model of a residential unit in Heraclea Minoa, a Hellenistic archaeological site on the southern coast of Sicily. A hypothesis has been sketched, moving towards the theory of a *sensitive heritage*, in which the experience of the visitor, documented by sensors and/or by an app from the mobile digital devices, contributes to maintenance and to management of the site.

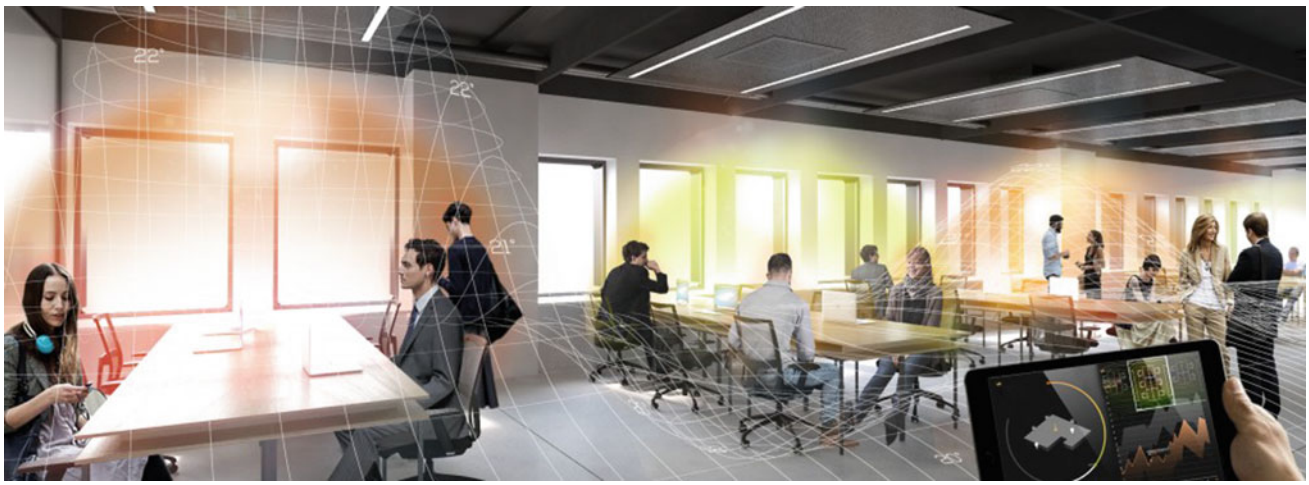

Fig. 11 Agnelli Foundation headquarter, housed in a historical building in Torino; representation of the *environmental bubble* www.carloratti.com/project/fondazione-agnelli

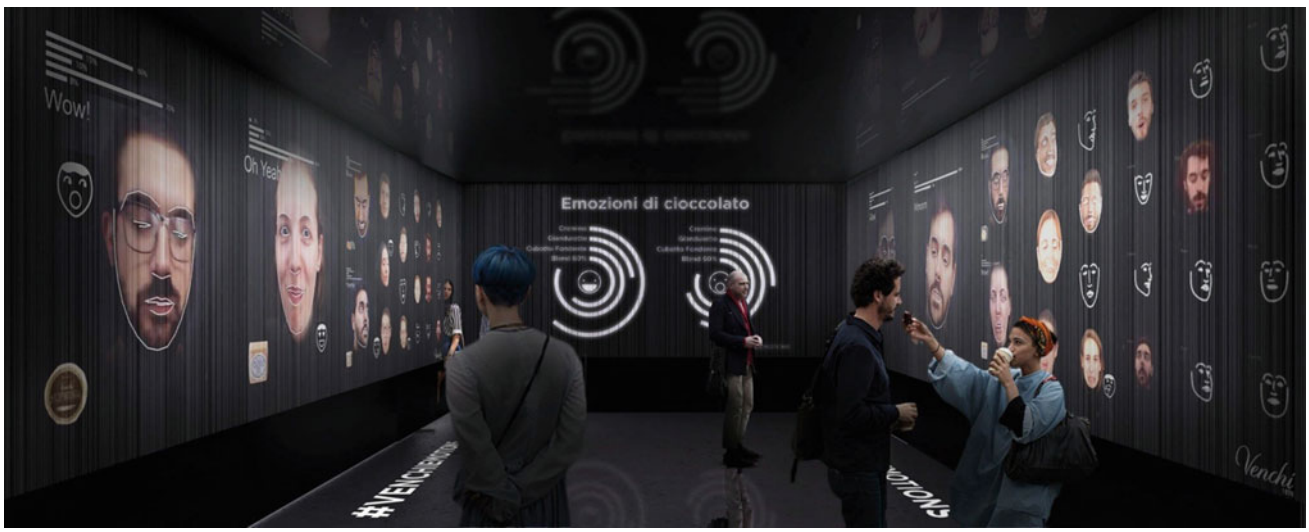

Fig. 12 Interior of the Venchi pavilion in Bologna *FICO Eataly World* (inaugurated in November 2017), where the recorded emotions of visitors, after tasting chocolate, are exhibited (Ashar, R. (2017), *Edible Architecture—an experience beyond*, October 2017; available at http://globalhop.indiaartndesign.com/2017/10)

The APER Project (Domestic Punic, Hellenistic and Roman Architecture: conservation and enhancement), funded by the European Union as part of the *Italie–Tunisie 2007–2013* cross-border cooperation programme and concluded in 2014, has paved the way to this latest research. In the framework of the search for the connection between knowledge, conservation and enhancement, in order to resolve certain operational aspects (and, not least of all, to tackle a lack of funds), the APER Project has proposed: a strategy founded on a technological approach, as the basis

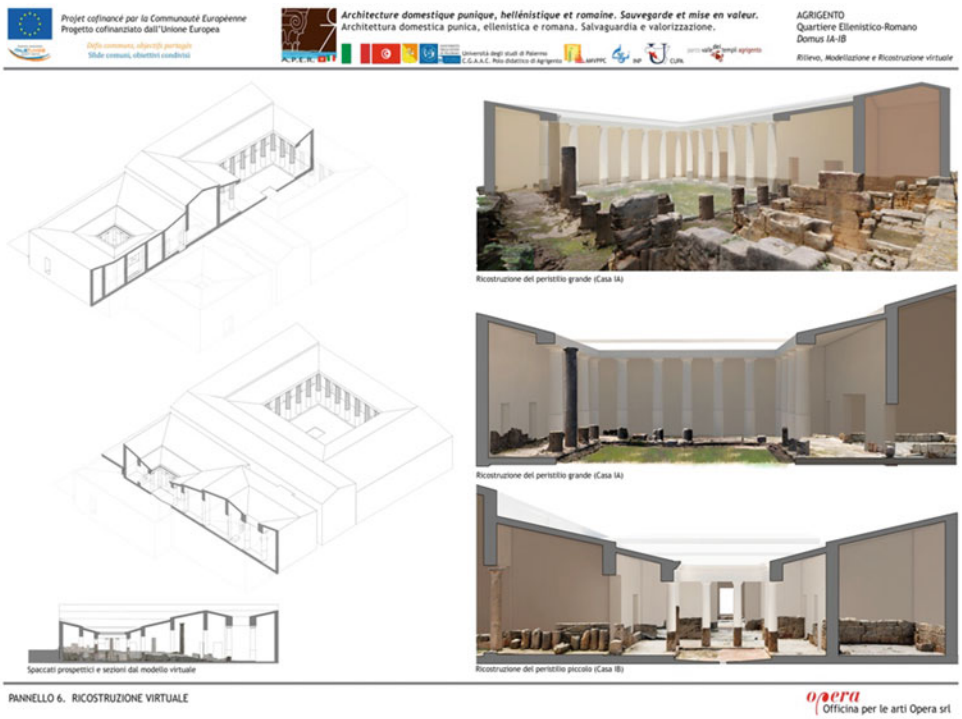

Fig. 13 Some of the results of the APER Project. On the top, survey and virtual reconstruction of the Domus I A and B of the Hellenistic-Roman quarter of Agrigentum; on the bottom, browsing tips for augmented knowledge (Ferjaoui and Germanà 2014)

for a multidisciplinary effort; a process-based view, considered as the main tool of overall efficiency, hinging on systemic knowledge in which the visitor can play an active role (Fig. 13) (Ferjaoui and Germanà 2014).

8 Digital Technology and Architectural Heritage: Theoretical Developments

While these rapid operational and process transformations are going on, a slower and invisible evolution is taking place in architectural heritage as a consequence of the *Fourth Industrial Revolution*; other major changes, readable from a multiscale viewpoint, are gaining substance and becoming more widespread, but they will probably induce more incisive and visible transformations in the medium and long term. A series of disruptions has marked technological evolution over the last centuries, from the emergence of industrialisation to digitalisation. The *First Industrial Revolution* caused a disruption of traditional productive processes, paving the way for a distancing from the contemporary, from which the actual idea of cultural heritage has derived its roots. On the other hand, the *Fourth Industrial Revolution* is causing a theoretical evolution; in less than a generation, it has given rise to a disruption that has started to change not only the way of producing but also the way of thinking, because it is transforming the individual and collective perception of two fundamental concepts: Time and Space. In the light of these theoretical transformations and their ethical and social consequences, a profound parallel revolution is foreseeable in the meanings of the architectural heritage and its social role.

The reciprocal influences of technology and society, occurring ever since the earliest historical epochs (Singer 1954), have changed with the advent of digitalisation and they have lost their customary contact with human experiences. Since communication has been indicated as the main feature of the relationships on which society has based itself and evolved, it has been considered one of the key aspects in understanding the current trend: *(…) the new communication system radically transforms space and time, the fundamental dimensions of human life. Localities become disembodied from their cultural, historical, geographical meaning, and reintegrated into functional networks, or into image collages, inducing a space of flows that substitutes for the space of places. Time is erased in the new communication system when past, present, and future can be programmed to interact with each other in the same message. The space of flows and timeless time are the material foundations of a new culture that transcends and includes the diversity of historically transmitted systems of representation (…)* (Castells 2010, p. 406).

The substitution of the *space of places* by the *space of flows* has provoked a loss in the contiguity of social practice, with the specific material support that was previously indispensable (Castells 2010, p. 431); this might create a conflictual situation in the built heritage, the peculiarity of which embraces a relationship with a specific place. Digital technology has brought about a sort of eradication of the architectural heritage: the virtual visit often replaces the real one and, consequently, there emerges the risk of disregarding the actual conditions, having faith in indirect recommendations (no matter how reliable) from someone who might have come across—in a specific manner and time—certain architectural heritage. With the aim of combatting this trend, research into the enhancement of archaeological sites has indicated the solution of identifying and reinforcing the relationships between the architectural heritage, the contextual environmental and socio-economical conditions, by going beyond a site-centric vision (Ferjaoui and Germanà 2014).

Timeless time, time that is instantaneous or with multiple temporalities, has led to the loss of the continuity that, before the advent of digital technology, distinguished between visions of Time, both linear and cyclical. This sort of intermittent time, coherent with the binary logic of the computer, raises legitimate questions regarding the very idea of *Heritage*, and not only on foreseeable developments in future generations. As a consequence of this compressed and undifferentiated digital time, in which the sequence of events is dissolved in a *perpetual present*, will the memory still possess meanings, or rather, which *forms* will our memory possess (Yuan 2016, p. 127)? Furthermore, due to the fact that the *processes of human memory are adapting to the advent of new computing and communication technology*, a sort of *transactive memory* (in which collective and outgoing forms have taken the place of individual and ingoing ones) will spread, something very different from the memory we are used to (Sparrow et al. 2011).

As a synthesis of these theoretical transformations, it is enough to mention that digitalisation has produced profound changes in communication, which also apply to the architectural heritage, leading researchers to a crisis point when dealing with any representation: the advent of multimedia *is tantamount to ending the separation, and even the distinction, between audio–visual media and printed media, popular culture and learned culture, entertainment and information, education and persuasion. Every cultural expression, from the worst to the best, from the most elitist to the most popular, comes together in this digital universe that links up in a giant, non-historical hypertext, past, present, and future manifestations of the communicative mind* (Castells 2010, p. 403).

Fig. 14 A teenager, while dancing to the pop song *Happy* in the archaeological site of Utique (Tunisia), aiming to reproduce himself in a globally shared video: a valuable example of sense of belonging, which conservation of the architectural heritage needs (https://www.youtube.com/watch?v=s2hqBPKQvqM, accessed in April 2014)

9 Conclusion: Rethinking the Architectural Heritage

This article has tried to synthesise a very wide-ranging and complex issue: the evolution of the connections between technology and architectural heritage, from the *First Industrial Revolution* to digitisation. For reasons of conciseness, a focus has only been placed on a few points that may be significant to understanding the main phases of this evolution, on the future of which the scientific community should reflect.

Architectural heritage does not belong directly within the category of objects: firstly, it is a concept that has emerged from a general cultural environment in which its meaning has matured. Ignoring the essence of *concept* in architectural heritage, transforming it into a *preconception*, might be a mistake that prevents the dynamic vision necessary to understanding the profound theoretical and operational transformations of the current scenario. However, at the same time, ignoring the essence of the physical object in architectural heritage, in the excitement of the fascinating potentialities of digitalisation, may be an even worse mistake that threatens the permanence of these testimonies to past ages.

Considering the risk of extinguishing the basic connotations of architectural heritage, as a consequence of the obsolescence of its theoretical foundations in the wake of digitalisation, there is an urgent need to rethink its current and anticipated role. The dynamic connections between technology and architectural heritage may offer a key to interpretation, aimed at rethinking both of these themes. On the one hand, the field of architectural heritage might increase awareness of the processes of knowledge, conservation and enhancement, by applying a synergic and uniform, technological approach. Digitalisation's potential in achieving a virtuous, rather than virtual, reality could be addressed in removing architectural heritage from the rather haughty isolation of the niche to which it has been consigned over the last hundred years. On the other hand, within the framework of the *space of flows* and *timeless time*, architectural heritage might represent, for current and future generations, the cornerstone on which the difficult but invaluable coexistence of global dimension and local identity might be created (Fig. 14).

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Historic Urban Regeneration Concepts: a Rethought for Indian Context

Sonali Roy Chandra

Abstract

Two primary questions always arise whenever one thinks of conservation: why and for whom to conserve? As a trained conservation architect, one has always justified the projects of conservation and found answers to the 'why' and for 'whom', but with time and more exposure to live studies and primary surveys it was realized that the professional view may or may not match the common man's view. In such cases of differences of opinion, is it right to impose our views on the public or is it time to re-think about the way conservation theories have been advocated and try to find a common ground of interest between the public and the professional ethics? In this paper, an attempt has been made to argue against certain standard theories of conservation from the Indian contextual ground and arrive at **'Neo-Value' Heritage conservation theories**.

Keywords

Urban regeneration • Indian urban conservation • Urban villages • Patan • Shahjahanabad

1 Introduction

Theories of conservation have evolved through ages, and the latest theory globally adapted is the recommendations for the Historic Urban Landscape by UNESCO in 2011. This theory though generic in nature clearly specifies that application of its recommendations should be in relation to a particular context. In accordance with the above, various concepts of Urban Regeneration have been proposed by various researchers and professionals in varied contexts. A group of researchers in Egypt has evaluated four basic conceptual approaches: the physical approach, the social and economical approach, planning and management approach and the communal approach by focusing on selectivity, integrity, authenticity and sustainability (Hoda Zeayter 2017). Researchers from Hong Kong have tried to investigate the role of social factors in urban renewal projects and the impact of the projects on enhancing a community's sense of place, identity and development (Esther Hiu Kwan Yung 2017). Researchers from China examined critical success factors (CSFs) in historic district regeneration projects of China. Six major factors of consideration are external environment, project characteristics, participants, project implementation, organization governance and the conservation of historic and cultural values (Tao Zhou 2017). Researchers from Norway have realized through their study that success of the conservation of areas constituted preservation plans combined with management tools to adopt changes necessary to modern living coupled with collaborative forms of governance (Torill Nyseth 2012). Research on specially protected heritage areas in Egyptian cities, termed 'Areas Enjoying a Distinctive Value', was studied, and their strengths and weaknesses were highlighted putting stress on the role of local governance (Tawab 2012). The role of public participation in decision-making, power imbalance in the process of urban management and the state of unawareness in public have been evaluated in the process of urban heritage conservation in Iran (Abidinb 2012). While studying the Heritage Conservation and Regeneration of Historic Areas in Malaysia, it has been observed that the vibrancy of a heritage site is only significant when its original community remains (Shahrul Yani Said 2013). The varied perspectives of conservation professionals worldwide have highlighted that the process of conservation of historic urban areas with mostly mixed-used patterns of residential and commercial poses the greatest challenge due to their dynamic nature and aspirations for development in all spheres of built heritage, natural environment, culture and economy. These complex issues need to be re-evaluated

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from time to time as the context keeps on changing with the passage of time.

2 Framework

The concepts of urban regeneration have been evaluated through primary case studies at various small- and big-scale heritage areas in India. The areas of study were Patan (Gujarat), Shahjahanabad (Delhi), Malapanagudi and Anegundi (Hampi). The scale of these areas varies, and hence, they represent their own set of challenges, with Patan being a small third-tier historic urban area, Shahjahanabad being an urban village of the capital Delhi, and Malapanagudi and Anegundi being living heritage villages of the World Heritage Area Hampi. Typical streets were studied for evaluation.

The Recommendations on the Historic Urban Landscape by UNESCO have been taken as the base document for global ethics of conservation, and local relevant documents have been considered for comparison along with data through primary study and survey at the above-mentioned heritage areas in India. Patan is in close proximity sharing cultural values and similar built heritage to the recently declared 'Ahmedabad World Heritage City, Ahmedabad' and hence, its dossier has been considered for evaluation. In case of the urban village of Shahjahanabad, renewal schemes are already in the proposal stage by Shahjahanabad Redevelopment Corporation, a government body formulated for development of heritage urban areas in Delhi; hence, its proposal is of significance for the Indian context. The intentions of the Historic Urban Landscape Recommendations and the aspirations of the Indian government measures have been evaluated against the challenges of the sites studied, and the conflicts in the two have been highlighted. An attempt to give an appropriate direction for the approach to conservation of urban areas in complexities of India has been made.

3 Discussion

Two primary questions always arise whenever one thinks of conservation: Why and for whom to conserve? As a trained conservation architect, one has always justified the projects of conservation and found answers to the 'why?' and for 'whom?', but with time and more exposure to live studies and primary surveys it was realized that the professional view may or may not match with common man's view. In such cases of differences of opinion is it right to impose our views on the public or is it time to rethink about the way conservation theories have been advocated and try to find a common ground of interest between the public and the professional ethics. In this paper, an attempt has been made to argue against certain standard theories of conservation from the Indian contextual ground and arrive at **'Neo-Value' Heritage conservation theories**. The primary concerns to resolve through the discussion are 'why?' to conserve and for 'whom?'

3.1 Why Conserve Footprints of Historic Urban Areas?

As per the Recommendations on the Historic Urban Landscape: *Civic engagement tools should involve a diverse cross-section of stakeholders, and empower them to identify key values in their urban areas, develop visions that reflect their diversity, set goals, and agree on actions to safeguard their heritage and promote sustainable development. Research should target the complex layering of urban settlements, in order to identify values, understand their meaning for the communities, and present them to visitors in a comprehensive manner. It is essential to document the state of urban areas and their evolution, to facilitate the evaluation of proposals for change, and to improve protective and managerial skills and procedures* (UNESCO 2011).

As per Ahmedabad World Heritage City dossier: *The foot print of the settlement pattern in the historic city of Ahmedabad on its topographical setting is an important cultural attribute that is more or less preserved in its historic character. The way the settlements are planned, the plotting of the houses in each settlement through its evolution over time periods expressing type of land plotting and its organisation and the periphery of the historic town is still expressing wholeness and is to a great degree intact in the historic city. This is an important attribute that display integrity of the cultural heritage* (Corporation 2016).

Argument 1: Built Footprint Symbolizing Social Footprint of Past The built layout of these urban historic cores is representative of certain social values, which are rather a deterrent to the modern way of liberal life. The layout in Indian historic cities was designed in accordance with the caste profile of people, families belonging to same caste, usually distant relatives, practising the same skills for livelihood and bound by same cultural traits-grouped together in one sector of the city called 'wadas'/'pada'/'pole' (ref. Fig. 1) The upper-caste padas were mostly holding important locations in the layout, at the centre near temples and palaces. The hierarchy of the castes can be observed spreading from the centre outwards to the periphery with the untouchables outside the periphery of the settlement. In certain villages in India, this practice of settlement pattern as per caste is still followed. In village Dangarthal, near Jaipur, Rajasthan, the cobblers practising leather works are kept at the furthermost end of the village periphery as they are from the lower castes

Fig. 1 Plan of different caste-based wadas at Patan, Gujarat. *Source* Documentation of Patan, Design Studio first year (2013–14), studio co-ordinator; author, University School of Architecture and Planning, GGSIPU, Delhi, India

of the cadre, also this ensures that the stink from dead skins of animals is not disturbing the sanctity of the core of the village (Studio 2013). Similarly, in living heritage village Malapanagudi, near Hampi, the untouchables are forced to reside at the outer most ring of the village and are still not allowed to drink water from the same public taps as can be used by the upper-caste residents (Chandra 2007).

These pada systems in historic urban cores, once signifying the caste segregations in society, have no significance in contemporary liberal urban lifestyle. Moreover, the population in these padas is no longer sacrosanct and there is a mixed population from different castes who do not share any common cultural traits. As a result, these padas do not hold any significance to them as a unifying code, but are merely a basic shell for shelter. Thus, the primary question arises, do we need to retain these footprints which do not hold any value in contemporary lifestyle and rather are a reminder of the past deterrent values? In India, in the field of conservation, layering of history is appreciated, but the testing of conservation principles against moral social values to take decisions is not seen as a common practice.

Argument 2: Built Footprint a Response to Past Context The historic footprint was built in the context of previous resources and infrastructure available. The narrow lanes were designed to cater to the width required for movement of bullock carts and pedestrians. The scale of the city was easily captured by pedestrian movement. They clearly do not suffice for the movement of four wheelers, service lorries and much needed parking areas as per the requirements of present-day context. Studies have shown that as per the level of satisfaction of the residents depending on several factors like rent, cost of living, infrastructure, location, etc., in the historic urban areas, around 50% of the population wanted to shift out of the historic urban areas (Subrata Chattopadhay 2014). As per the survey at Shahjahanabad representative streets, the major reasons for people opting to move out of the historic area are lack of parking area, congestion on streets due to illegal parking of rickshaws and two wheelers and lack of open spaces for recreation (ref. Fig. 3). As per the proposal for redevelopment of Shahjahanabad by Shahjahanabad Redevelopment Corporation, the street pattern in residential areas is proposed to be restructured with linkages from the metro stations. The minimum road width and prioritizing of road widening are dictated by fire and other disaster management criteria. The streets, having 30–50 m lengths, shall have a minimum of 3 m width and streets having more than 50 m length shall have a minimum of 4.5 m width. Common facilities shall be located with linkages to pedestrian roads and metro stations (SRDC 2015) (Fig. 2).

3.2 Why Conserve Authenticity and Integrity

As per the Recommendations on the Historic Urban Landscape: *Knowledge and planning tools should help protect the integrity and authenticity of the attributes of urban heritage. They should also allow for the recognition of cultural significance and diversity and provide for the monitoring and management of change to improve the quality of life and of urban space. Special emphasis should be placed on the*

Fig. 2 Plan of street studied at Shahjahanabad, Delhi. *Source* Documentation of Patan, design studio first year (2013–14), studio co-ordinator; author, University School of Architecture and Planning, GGSIPU, Delhi, India

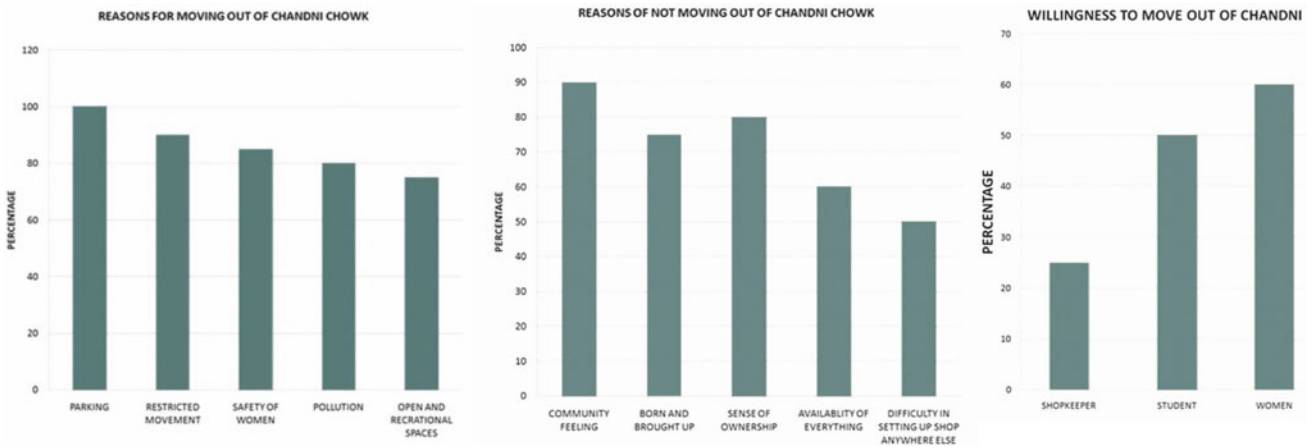

Fig. 3 Perception of residents of Shahjahanabad (alias Chandni Chowk). *Source* Study of historic core of Shahjahanabad, elective studio of urban issues from third year (2016–17), studio co-ordinator; author, University School of Architecture and Planning, Guru Gobind Singh Indraprastha University, New Delhi

harmonious, integration of contemporary interventions into the historic urban fabric (UNESCO 2011).

As per Ahmedabad World Heritage City dossier: Integrity is maintained in the footprint of the settlement, in the house forms, in historic sites and in the architectural expression. Likewise Authenticity can be observed in form and design, material and substance, use and function of houses, traditions techniques and management systems (Corporation 2016).

Argument 1: Maintaining Authenticity Change in these historic urban areas is inevitable. At Shahjahanabad, 47% of people in the area of survey, belonging to the third generation of residents, had carried out renovation of their properties to fit the needs of their growing families. The shops on the ground floor were mostly rented out due to lack of sense of ownership towards the property being maintained with minimum changes. The challenge is to monitor and give direction to such changes to maintain authenticity as per the conservation theories. Hurdles for the accomplishment of above are multifold. The professionals and government organizations like Shahjahanabad Redevelopment Corporation, in the case of study area, admit that though the Master Plan Delhi 2021 recognizes Shahjahanabad as a component of separately designated special area, lack of a conservation management plan or heritage bye-laws have led to poor-quality additions of floors and the introduction of many illegal industrial activities, leading to higher susceptibility to seismic destructions and fire hazards. Incidents of building collapse have also been reported. Most of these properties are owned privately, and there are no funds available nor are there any tax redemptions for heritage property owners (SRDC 2015). The competent authority of Delhi along with

the Archaeological Survey of India does have a stringent permission procedure with forms available online for the same for seeking permissions for changes in property in restricted heritage areas (ASI 2011), but compliance with these approvals is very poor. Capacity building programs for the masses, to convince them to adopt good practices of building, are yet to be undertaken. Provision of laws and guidelines is not enough to ensure its implementation. The second major hurdle is the unsupportive market. Conservation professionals in India have not turned their attention so far to develop and improvise the traditional building materials and techniques so that they can be readily available in the market and at an economic rate. This last lag of development in the field is very crucial, since the traditional building materials and techniques are out of reach for the public and are only restricted to be used in government-funded projects. The table below, highlighting the higher cost of mortar works in traditional lime than with contemporary cement, is evidence enough to project the status of market development of traditional materials. In Patan, the transformation of built from traditional to contemporary is evident and fast-paced (Fig. 4).

Fig. 4 Transformation of built from traditional to contemporary evident in the street plans above and elevations below at Patan. *Source* Documentation of Patan, design studio first year (2013–14), studio co-ordinator; author, University School of Architecture and Planning, GGSIPU, Delhi, India

INTACH schedule of rates 2013 (INTACH 2013)	Item: Lime mortar preparation of lime mortar 1:3 (1 lime: 3 sand) construct two tanks at ground level. One for slaking of lime and other for storage of slaked lime. Slake the lime in the tank mixing it with water. Water should be sufficiently more and above the lime. Mix and stir with wooden solid pole for three days under the supervision of conservation Architect. Sieve the sand passing through 4.75-mm sieve set. Take one part of slaked lime in a container and three parts of sieved sand in the same size container. Place these materials in a lime mortar miller. Grind the mix for a 12–15 min. Remove the mix from the miller and stack it in a storage tank for maturity period of 4–5 days. A good aggregate for a lime mortar should be with angular grains and free of contaminants such as salt and organic matter. The aggregates should be well-graded sand which typically has grain sizes between 4 and 0.125 mm, with the largest proportion of grains at the mid-point sieve fractions	Quantity	Rate in rupee per cum.
	Lime mortar 1:3 (1 slaked lime: 3 coarse sand)	Cum	7588.17
DSR 3.8 (PWD 2013)	Cement mortar 1:3 (1 cement: 3 coarse sand)	Cum	4347.70

3.3 Conserve for Whom?

Argument 1: Decreasing Number of Original Residents In India, in most of these historic urban areas, the original residents are left as a marginal number, most of the residents are third-generation new owners, and a many are floating population on rent in such areas. It is estimated that about 75,000 persons per year are still migrating to Delhi comprising of 16% of the total population of the city (Delhi 2013). The Old City areas, such as Shahjahanabad are fast changing their residential character to non-residential use. As is found typical of the central core of metropolitan cities, the residential population of the walled city has steadily declined from 0.42 million in 1961 to 0.25 million in 2001, but the residents are being replaced rapidly by commercially inclined users (SRDC 2015). The sense of belongingness hence is very low in these residents resulting in low level of commitment towards maintaining the authenticity and integrity of the historic built environment. While in metropolitan cities, the migration is inwards, in smaller towns like Patan, Gujarat, the migration is outwards to bigger towns for better opportunities. In the study area of Patan, it was observed that a prominent number of houses were locked up and unoccupied (ref. Fig. 5). The rest of the original wada residents had also slowly moved out to other parts of the city and the wadas now housed a mixed floating population of a large number of tenants. In both situations of an inward or outward migration, due to decrease in number of original residents, the big question lurking at the face of the conservation field is, 'whom' are we conserving for? The nature and strength of the direct stakeholders are changing and in this case what would be the nature of decisions and how much shall they respond to the indirect stakeholders? The concept of collective memory is questionable since the stakeholders themselves are changing in nature. Whose memory are we to safeguard and to what extent? It is also worth evaluating whether the collective memory of the indirect stakeholders is nothing more than a huge expression of nostalgia, sometimes made stronger by draping it under the cloud of national pride, and is this nostalgia pushing us towards preservation rather than conservation which is pro-development?

Argument 2: Cultural Continuity The cultural practices in India are closely related to one's caste and were strongly reflected in the built environment, which can be clearly read in historic settlement areas. The layout of houses reflected the cultural traits of levels of privacy maintained in each sector (ref. Fig. 6), and details of ornamentation were symbolic representations of religious beliefs (ref. Fig. 7). With time, now that the original residents have moved out in large numbers and a floating population has replaced them, the mixed groups do not give a strong platform for the continuation of any cultural practices or rituals. The residents on rent do not associate with any of the symbolism or cultural ethic embodied within the built form of these areas. The sense of culture needs the cohesion in beliefs which is weakened due to a mixed population group, as against the historic tradition of same caste inhabitants in a pada. All these factors and the dynamic nature of culture propagate a need to redefine culture from time to time for a set of people by the people themselves.

Argument 3: Economic Development for 'Whom'? As per a survey, out of the total establishments in central part of Delhi, only 2.7% are engaged in handloom/handicraft

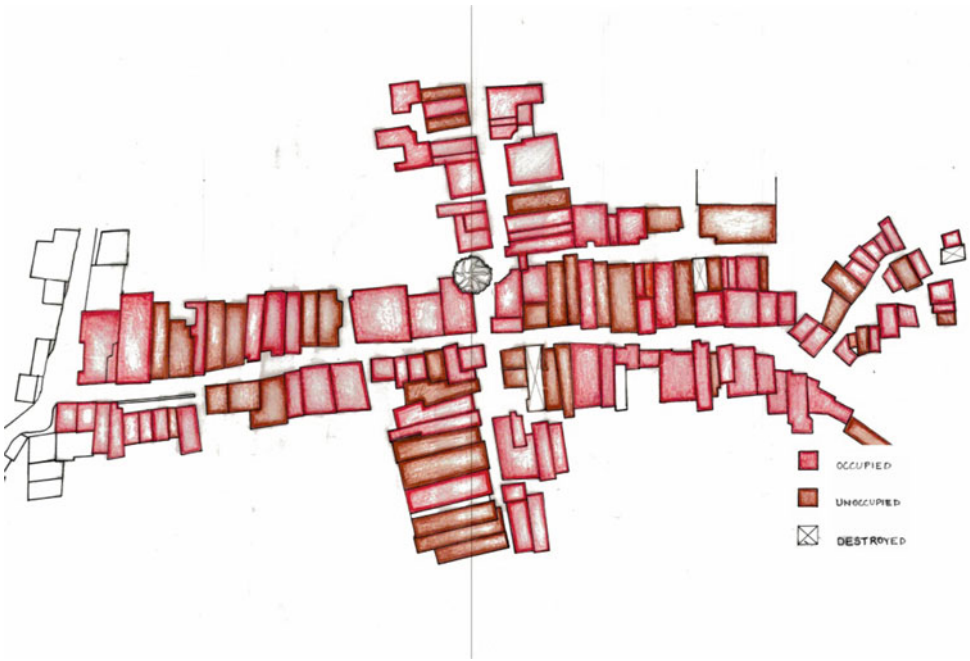

Fig. 5 Plan of street at Patan showing ratio of occupied and considerably large number of unoccupied residences. *Source* Documentation of Patan, design studio first year (2013–14), studio co-ordinator; author, University School of Architecture and Planning, GGSIPU, Delhi, India

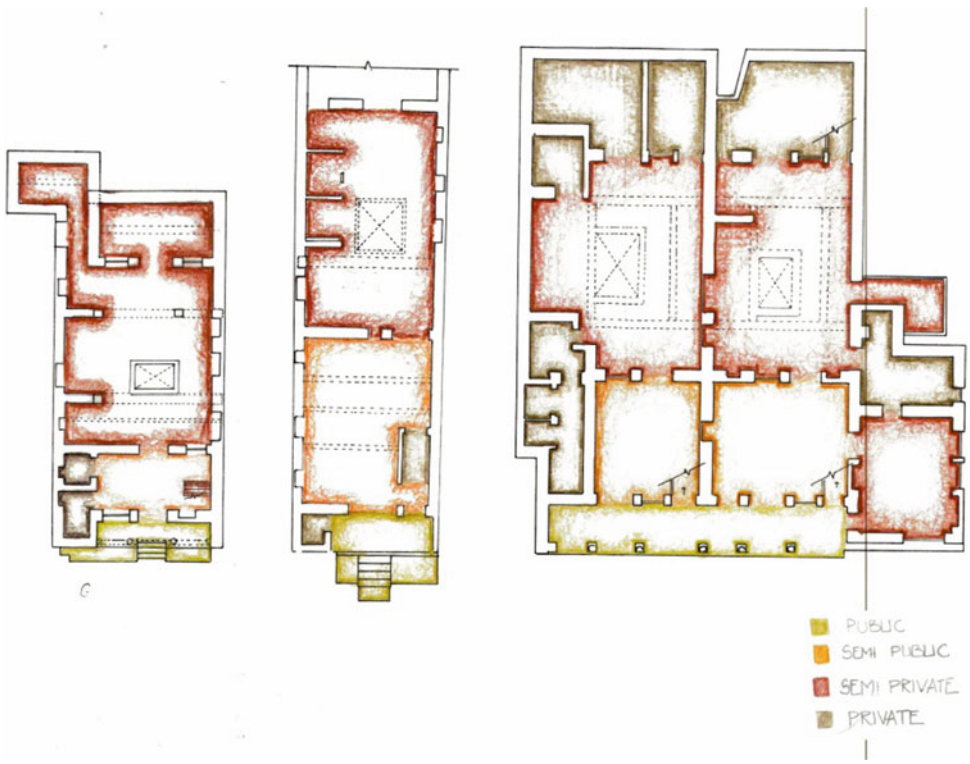

Fig. 6 Plans of different typologies of houses at Patan belonging to different caste showcasing different levels of privacy for visitors. *Source* Documentation of Patan, design studio first year (2013–14), studio co-ordinator; author, University School of Architecture and Planning, GGSIPU, Delhi, India

industry (Directorate of Economics and Statistics 2013); the people engaged in the unorganized sector of employment is significantly high in Central Delhi given the high number of migrants and homeless labourers (IHD–IRMA 2010). The constantly degrading environment in the walled city has a negative impact on its economic growth (SRDC 2015). As per the study in the Shahjahanabad, area, the businesses of the past had to be changed, as per the changing market trends by the small business holders, and economic growth still is very challenging.

In Patan, the lack of job opportunities has reflected strongly on outward migration. As per the study, the traditional weaving of the city Patola Ikat is being safeguarded and

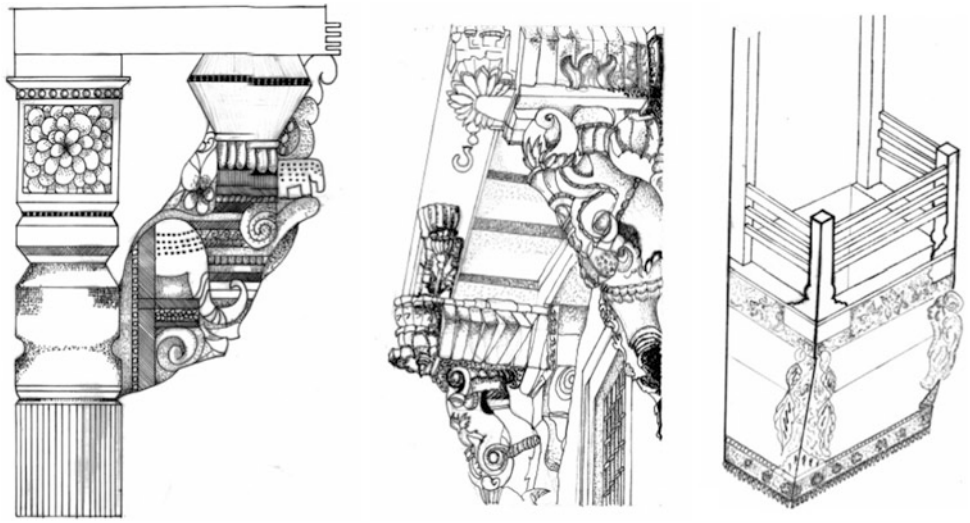

Fig. 7 Different ornamentations from different houses at Patan belonging to different castes symbolizing different beliefs. *Source* Documentation of Patan, design studio first year (2013–14), studio co-ordinator; author, University School of Architecture and Planning, GGSIPU, Delhi, India

practised by only one traditional weaver's family. Capacity building strategies to revive this traditional craft should be incorporated but with a vigilant eye. Many times, organizations claiming to promote traditional crafts and generating employment for the locals do not have a transparent fiscal record. The profit margin gained by sale of the such products in the market is more than the amount given back to the local artist. Such cases were seen at a heritage village of Anegundi near World Heritage Site of Hampi, Karnataka, where an NGO under the umbrella of Rural Development schemes is monopolizing the trade of crafts and the amount of profit shared by the artists is nominal. The other area of concern is the continuity of values in the practice of such traditional crafts. Traditionally, all crafts were practised by a particular caste of the society, society was divided by work profiles, and skills were passed down from one generation to another. These crafts and sources of livelihood were thus closely associated with their lifestyle and beliefs. In this context, it was noted in a bamboo craftsmen caste in living heritage village Malapanagudi, near Hampi, the God of this particular caste was a personified version of the craftsman himself and preached many a value of zero wastage of bamboo, as a product and craft as mode of service to society. This way their livelihood was closely associated with their lifestyle by means of religion and belief systems. In case of capacity building when people of other community and caste would be trained in this craft, it would be a challenge to continue the value systems so deeply rooted into bamboo craftsmen's caste beliefs (Chandra 2007) In another case, the NGO employed artists from West Bengal to build a roofing visually resembling the local vernacular roofing typology since the local craftsmen were charging higher rates. Thus, they were able to project promotion of local building crafts, but if one inspected closely and inquired deeply, would get to understand that it was a visual trap and that it was a total failure of the motive of local employment generation through these schemes (Chandra 2007).

It is evident that though the population of Shahjahanabad is increasing, it is an increase in the migrant population and an outward migration of residents is seen, owing to the degrading of opportunities and environment, while in Patan it is evident that the sheer lack of job opportunities is resulting in an outward migration trend, in both cases demonstrating that economic growth of an area in quality formal sectors is the key towards a sustainable living environment.

4 Conclusion

Architectural conservation started initially with an intention to preserve and restore monuments of historic significance. The field since then has evolved immensely in multidirection and has moved up to the consideration of tangible and intangible heritage, but still the older notion of safeguarding the history of humanity has survived as the central chord for all decisions. The vast and complex nature of historical areas and the constant pursuit of support for the cause of preservation against the rapid changes has made the professionals so engrossed that their vision of the field has been restricted to some extent. The ultimate motive, to look back at history to learn for the future, is not being realized strongly. History is still looked upon as an interpretation of material remains and hence the stress on preservation of material culture. The notion that history is much beyond this, as a metaphysical knowledge system, is yet to take roots. Once we start concentrating on this knowledge system and not so much on the physical remains, our barriers of nostalgia shall break and

we shall be able better to define the future. In certain cases, it would be much easier to let go of historic structures which are not suitable for today's context, after extracting the knowledge embodied in them, and not force people to inhabit such structures, risking their lives and compromising their health. Presently, very little to no research is being undertaken to improvise on traditional systems for modern industry, for example, lime such an excellent historic material has not found its space in the research nor industry to make it as readily available as cement in the Indian market. Secondly, there are not many great examples of modern buildings in improvised traditional systems to aspire their common man.

Economic upgradation may or may not be a traditional source, since, as discussed, traditional forms of livelihood, closely linked to cultural practices, may have to be redefined carefully otherwise they may not be true to their roots. A balance of job creation in traditional as well as contemporary industry shall have to be strived for. Thus, drastic economic reforms, along with infrastructural upgrading initiated by government and supported by public, have to be achieved to retain the original residents of these historic areas; otherwise, the notion of collective memory and sense of belongingness shall become weak and unaccountable. The identity of place without the original inhabitants would make no sense, as it would become a hollow notion falsely projected for the tourists alone.

Conservation will never be successful in its true sense until the government, market forces and the will of the public are aligned towards acknowledging the historic knowledge system as modern. Till then, the principles of conservation will be alien to the masses upheld by a select few. Till then, conservation architects should be busy trying to extinguish the fine line between development and conservation. The recent withdrawal of the nomination of the city of Delhi as a heritage city by the Central Government of India showcases the pertinent fear in the minds of many of seeing conservation as a barrier towards development (TOI 2015). This is the real challenge of the field of conservation, to move from mere **Restorative theories** to **Inventive theories for the future**.

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Part II
Promotion of Heritage and Cultural Tourism

The second part of this book focuses on the ways to promote heritage and cultural tourism. This is especially evident in chapter nine, "Exploring Heritage Preservations and Enlivening the Cultural Awareness," where the author focuses on the urban heritage of chronicled areas within the city's development. According to the author, encompassing historic buildings provides crucial correlations between the historic district and the urban context for accomplishing a sustainable conservation action plan to meet the needs of society. The chapter discusses various hypotheses and perceptions regarding cultural heritage to explore the definitions of heritage throughout history and how the conflicts in considering and distinguishing heritage influence its approaches towards conservation.

Chapter ten titled, "Adaptive Re-use in Tunisia Between Remembrance and Contemporaneity," aims to understand the process of transformation of a heritage building and to determine the degree of relevance of this intervention according to a theoretical method of objective analysis, which opposes the duality of heritage values defined by Aloîs Riegl: remembrance and contemporaneity. In order to achieve this aim, the authors evaluated the quality of reconversion of this rich and diversified corpus of study according to fourteen criteria of relevance, which they identified from a bibliographical search and classified into two main categories of values of the heritage: remembrance and contemporaneity.

Similarly, the authors of chapter eleven, "Revival of Sudan's Architectural Heritage and Tourism, " highlight Sudan's potential sites for tourism development by conserving existing pyramids and remotely placed antiquities related to Kush. On the other hand, chapter twelve titled, "An Architectural Project of Giovanni Maria Falconetto Discovered During the Restoration of the Alvise Cornaro House," presents arguments and conclusions of the case study: the restoration of the house of Alvise Cornaro in Padua that was carried out between the years 1983 and 2000. The author describes this venue as a place for comedies and small concerts due to the presence of two buildings of great architectural quality: Loggia and Odeo.

The final chapter in this part, "Investigation of Daylighting Performance in UAE Heritage Museums," addresses the United Arab Emirates' practice to transform many of its valuable heritage buildings into museums, so the authors raised the question of "how well can these buildings perform as museums?". This chapter analyzes the daylighting environment in the indoor space of a selected building case that relies on one of the most common daylighting systems found in the heritage architecture of Dubai (latitude 25°N longitude 55°E); i.e., the heritage Dreesheh window.

Exploring Heritage Preservations and Enlivening Cultural Awareness

Amr Abdelfattah

Abstract

The improvement of any city interacts with diverse architectural characteristics and illustrates its history of this amelioration through exceptional architectural styles. The built heritage might be spared and enhances the quality of life for local residents by utilizing accurate conservation strategies. This paper represents the urban heritage for the historical areas within the city's development. Moreover, the encompassing historical buildings promote the crucial correlations between the historical district and the urban context for accomplishing sustainable, conservation action plans concerning the requirements and the imperative role of the domestic society. The paper discusses various hypotheses and conceptions regarding cultural heritage for exploring heritage's definitions through history and discusses the various disputes in distinguishing heritage may influence its approaches toward conservation. It explores the correlation between memory and place, and how the place affects history conducting in two distinctive correlative features, tangible and intangible, which formulates the double-faced guise of cultural heritage. It debates with the framework of heritage places and promotes the expanding awareness of intangible heritage's significance that acts as a marked aspect in the domain of heritage preservation. It affirms the heritage concept which is imparted over performance, acknowledged through experience, and illuminated by diverse activities that improve the place identity and maintains its spirit. The paper aims first to set an approach for the communities' desire to preserve their built heritage through community participation and second to propose the challenges and opportunities for sustainable advancement. It infers that urban heritage preservation and protection of the probity and identity of the historic districts can aid its marketing and advancement in several approaches that may enhance the domestic society's sense of belonging, users' experience, and quality of life. Finally, conclusions are drawn about the significance of discussing the physical characteristics of built heritage together with environmental, economic, and social aspects as the main concern of any sustainable development. The results, concerning surveying the lack and degeneration of the cultural heritage, ought to be examined, explored, and discussed while considering obstacles and sustainability issues which are related that urban heritage preservation.

Keywords

Cultural heritage and identity • Conservation • Memory recalling • Culture vitality

1 Introduction

The diverse activities and the existing land uses have deteriorated and changed due to the growth and rapid transformation of their social structure and economics particularly because of the huge population flows in different countries throughout the world, especially in the developing countries. As land uses are rapidly redefined, their social structures and economics represent a real threat to their different natural and cultural resources. Cherchi (2015) articulates the reusing of relatively urban open spaces and how they comprise an important opportunity to achieve more livable and sustainable cities through reviving and regenerating the inner city's areas. The historical cores in many countries are considered as the physical representation of the cultural and social traditions which define meaning and special identity to the society and the modern city (Steinberg 1996).

The key to sustainable development is presently considered local participation (Sirisrisak 2009). Integrating social participation into preservation and urban planning is useful and valuable for all sides (Yung and Chan 2011).

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Collaboration and connection with related and domestic communities is a fundamental matter as it is considered as part of improving sustainable strategies for the management (Kamel and Hale 2010).

The potential for imagining uses which present intellectually stimulating preferences, that produce and consume cultural and artistic products, could promote economic sustainability and assure appropriate economical returns, besides promoting the commercial standards that are considered as the real challenge (Giani and Carnevale 2015). Furthermore, the convergent memory and various traditional forms that improved by traditions should be incorporated in urban design with integration of community participation. It can enhance achieving a genuine cultural place identity, which is needed for the continuity of cultural social life, in addition to enhancing social cohesion (Chen 2011).

'We act now, modifying our environment for the future. We recall now. We learn now, which is to say we modify ourselves to act more effectively in the future' (Lynch 1972: 89). Kevin Lynch debates that providing an environment that supports learning and increasing awareness has the ability to recall the past by connecting the existing moment with an enormous time span, which is how historical places have been preserved for many years. In general, preservation has become, and is yet, concerned heavily with the perception of heritage as the demonstration of the past's essence as represented in its remains and residues. For instance, historical buildings were restored to their original state in the last century, where any alterations were entirely removed. At that time, the emphasis was to transform the original into a new style.

The field of heritage conservation has been dominated by the French concept of 'patrimoine' for several years, affirming the esthetic sense of grandeur, which reinforced the present's obligation toward the past, to value the monuments and to transfer them untouched for upcoming generations (Smith 2006: 67). The concepts of Ruskin with regard to historical buildings had undoubtedly a major impact on heritage conservation practices. He argued that historical buildings do not belong to the existing generation. That concept was considered as the main basis of the preservation tendency of 'conserve as found' (Ruskin 1865: 67).

There argument has been a major influence upon the practice of heritage conservation. It is considered an important path to preserve native identities, which are increasing every day, particularly after the movement of UNESCO in 1997. They were not satisfied with the geographic imbalance of World Heritage Sites because of the selection criterion which prioritises Northern and Western cultures more than Southern countries. These countries still act as an important portion of the world's heritage and should be equally preserved and maintained (Aikawa-Faure 2009). There is a consciousness that every place or community should be concerned with heritage conservation on their regional levels. Otherwise, it is recognized that shared intangible heritage has the capability to compose good principles for vigorous identity between different groups of people which happens when cooperating with perspicuous tangible residues which usually could be a reason for discussion among countries concerning their property.

One of the major conclusions that may be drawn from the literature review is that events progress and change is its modification (Tabraham 2006: 59). Therefore, heritage conservation is a procedure which consists of two major parts. The first part is preserving the physical remains to be passed on to upcoming generations. Managing the intangible heritage's modifications is considered the second part. This proposes that cultural events bring changes over time and that these should also be preserved.

Tiesdel et al. defined *preservation*, or what they call 'pickling,' as it is fundamentally involved in determining change, while *conservation* is described more as change's inevitability and the capability to manage this change. They described adjusting the change that takes place in historical districts as of enormous significance; as the gross impact concerning of comparatively minor modifications, over time, destroys the identity of a place (Tiesdell et al. 1996).

Conserving the tangible aspects of each historical venue should be applied with the aim of maintaining the tangible qualities which recognizes the intellectual image of the past. This conservation will have the ability to enhance these heritage aspects, which are symbolized in various cultural and social activities, promote its social identity, and preserve the cultural heritage of the place. Furthermore, it should be perceived that the modifications that might be occurring to the intangible cultural activities most probably would be less controllable without existing this physical image, which promotes both spatial and collective memories.

It is predicted that, as the conservation of tangible heritage was enhanced through the twentieth century, retaining both features of heritage and safeguarding the intangible features of its cultural legacy will be enhanced and consolidated by the twenty-first century (Kamel and Hale 2010).

The paper concludes that heritage preservation and its concept as an interlocutor, past and present, management of memory, and vitalizing the cultural guidance should be analyzed by merging the cultural contents and the context into one entity for a better comprehending, and consequently preserving and safeguarding the cultural heritage.

2 Research Aims and Objectives

The main aim of this research is to consider an approach to achieve communities' desire to conserve their built heritage, which may entail community participation and to propose

the difficulties and opportunities for sustainable improvement. This aim will be achieved by promoting domestic society's sense of belonging, users' experience, and quality of life which are utilized to aid the marketing and advancement of the urban heritage.

3 Research Methodology

This paper investigates the connection between memory and place, and how the place influences history leading in two correlative features, tangible and intangible, which defines the double-faced form of cultural heritage.

The paper considers the urgent role of urban society and seeks to explore the critical correlations, through the historical district and the urban context, for attaining sustainable preservation action plans.

This paper summarizes three different approaches in promoting cultural awareness: one, which suggests that the social identity and the sense of place ought to be featured for realizing its significance; another, which considers creating opportunities for promoting community participation and involvement through various activities; and a third one, which argues that the cultural enlivening should be preserved and improved with the support of the local communities.

4 The Interlocutor Over Past and Present

According to Kenny (2009), heritage is usually assumed to be the remains of constant residue without any discontinuity. However, it is readily observed that people use the expression of heritage generally for denominating their predecessors' residues which help in backing their meanings and memories and connecting them with their previous history. It provides people with a sense of belonging and a source of glory. People were not keen to understand history from the experiences of their predecessors in order to achieve, but they also cherished the remnants of past material to build their own identities.

There are two paths to deal with a heritage, which are generated from the most recognized two concepts of heritage derving from the literature review of cultural heritage.

The first approach, which is presently the most used to define heritage, understands it as remnants of the past that commonly solemnizes past glories and comprises diverse aspects of domination and power of certain civilizations and cultures among or in comparison with their counterparts.

This concept emerged in Europe, especially Britain, France, and Germany, during the era of modernism in the nineteenth century (Feilden and Jokilehto 1993; Smith 2006; Smith and Akagawa 2009). Smith (2006) proposed that it should be connected to the concepts of biology or blood. Smith argues that the notion of a common sense of heritage is recognized incorrectly as being old, large, huge, and/or esthetic places (Ibid). Definitely, it should be noted that Darwinism (Ibid) assisted to vindicate the connection between identity and race and pretended the progression of European cultural and technical accomplishments.

Furthermore, there has been an increasing potential to publicize the second concept of heritage during the last two decades of the twentieth century and markedly observed since the beginning of the twenty-first century. It is recognized as a result of an identity making and practice of meaning gadget which benefits from utilizing past memories and provides modern ways for modern generations to explore new concepts about their patrimonial values and mores by collaboration with the tangible residues of the past.

The second concept of heritage is defined as activities, or understanding, which is currently scientifically structured, which may be different from, but are closely related to, the same remnants. Kenny (2009) debates that the concept of heritage is defined as a process at the moment is permitted to a more effective understanding of producing and vitalizing cultural heritage. However, the continuous procedure of heritage structure is considered as an outcome practice to be improved and preserved (Ibid).

5 Contradictions of Heritages

Existing tangible remains today are monuments which are esteemed and classified according to their historical significance. These monuments are usually maintained and conserved either by preserving them in closed or open museums or by entirely preventing the public or, in another way, by the act of not permitting interaction between historical remnants and people that produced a huge gap over time between communities and their history, and consequently losing the practices of their own heritage.

The challenge with heritage, as existence activities and practices, is how to create, enhance, and explore the connection between the tangible remnants and the realization of their significance. This process demands the people's involvement in this understanding procedure and increasing their awareness, as well as requires the presence of proper landscapes which could simplify this process.

Although the tangible and the intangible values of people are linked in a very composite and reactive way, it is possible to assume, because of the two previously mentioned concepts of heritage understandings, and also current conservation practices, that attention has been drawn to a conflict admitting that cultural heritage is being separated. Therefore, it deals with physical residues that have been the basis of obvious preservation and safeguarding regulations,

and intangible meanings, significance, memories, feelings, and activities that occur if associated with historical remnants or not.

Smith (2006) argues that there is a specific trend to identify heritage and intangible heritage, as two distinct and various features over the global rating of heritage.

The modern perception of heritage suggests that historical buildings are heritage as soon as people understand them completely, by considering the meaning of those buildings as an important aspect in their social lifetime. Furthermore, historical structures are mere monuments which are safeguarded and protected as artistic pieces that may add additional pleasure to any place, however, not so expressive.

Alexander (1979) argues that tradition clarifies a significant part of the intangible heritage that inspires frequent lifestyles and is alleged to constitute spaces. The recognition of such patterns is necessary before any new feature is introduced to a current space which is assumed to present a modern change to the present styles. Misztal (2003) re-employed and applied these traditions to promote social identities and create a good sense of belonging. Misztal (2003) determines tradition as an expository schema that moves through different generations.

At the same time, (Misztal 2003) proposes the procedure by which social identity is channeled and sophisticated in a particular place, despite the fact that this combines the past nominal models within the current expertise. Misztal (2003) strongly urges that traditions could be guided by keying in order to make dramatic events, especially during periods of national emergency, by turning intangible values into tangible.

The debate on the ownership of heritage was also highlighted as the significant aspect of the challenge, like several tangible heritage, that pretended a strong relationship with their historic originals, which certainly reflects the different people of the past cultures that had occupied the same lands as today's countries. Thus, this query is raised if it is sufficient to be own or not enough. Moreover, the problem of ownership of intangible heritage appears to be much easier than the problem of tangible. This may be just the issue because intangible heritage is transmitted by users over time and from one generation to another and, thus, owned by these people rather than countries. Then, it needs the political impacts that largely direct the practices of tangible heritage in a good way.

Intangible heritage usually refers to communities, sets, and special places. For instance, the Japanese heritage will be always represented in the Kimono regardless of wherever it is worn and who wears it. As a model of a physical historical monument, the Egyptian pyramids shall constantly stay as an ancient Egyptian icon. However, some disputes have recently begun to appear because of the ownership of intangible heritage, as the shown power of intangible heritage that could be symbolized in the Palestinian scarf (Kamel and Hale 2010).

5.1 Identity Framework and Heritage

Correa (1983) has stated that identity could be improved by addressing what is perceived by the community as its issues, and he argues that it could be structured. He clarifies that identity is a procedure, not a resulting theme, that may be associated with the patrimonial cultural heritage of modern civilizations that formerly existed in a place and that generate unconscious identities (Ibid). Therefore, identity could be regarded as a tool which is utilized for cultural and historic conditions.

Cote and Levine (2002) argue that the structures of historical realities are considered as significant features for the social fact, while these aspects strongly affected the behavior of people during the present community. Cultural heritage is alleged to be usually used in building common identities for societies and communities (Hazucha and Kono 2009).

On the off chance that we think that distinguishing individuals through aggregating people into similar attributes, there are exceptionally clear categories that individuals are recognized by since their birth, as nationality and sexual gender. In spite of the fact this it relies on some aspects as their place of birth and guardians' nationalities that made some generations endure from identity loss. For instance, migrants to numerous European cities are considered as non-locals by native residents, and in the meantime, their original parents' home-countries locals consider them non-inhabitants, particularly while they come from various ethnical communities.

Gathering individuals into categories is deemed as part of the social identity concerns. These sets could be started by at least one or more reasons notwithstanding those previously referenced. Some are identified with the individual's physical attributes that cannot be varied, and however, others are identified with beliefs or ideas that individuals embrace that may change any time now and then. For instance, naming individuals' identities in light of their religion as Jews, Christians, Muslims, or even sub-religious identity may occur, similar to Shiite, Sunni, Orthodoxy, Catholic, and so forth; or in view of their belief systems: Conservatives, Liberals, and Socialists; or in view of their ethnical gatherings, as we can discover: White, Black, and Gipsy; or in light of their origins.

Within a significantly more extensive concept other than that of nationality, the identity may have various standards. It begins with identifying individuals in the light of their continents, nations, areas, and urban communities, to identify after particular residential districts contingent upon the compelling forces and significance of such inceptions. For

instance, individuals can be assembled as Europeans, British, English, Londoners, and so forth.

Hence, individuals as people may have a place with additional public character or identity. While considering participation with others their destiny, points, glimpses, visions, objectives, or history, as defining those identities may rely upon the circumstance they are defined in Cuno (2010) depicts the quality of having double nationality and, in addition to, double societies like: Individuals appreciate connected and dynamic identities, which are comprised of numerous segments that are combined to demonstrate their distinction.

Heritage as a social procedure strongly affects the arrangement of individual and social identities. Consequently, understanding a place's history and practices of heritage serves to attach individuals to their past, while at the same time cultivating their feeling of pride and promoting their sense of belonging. Memory has started to be broadly called upon for the specifical motivations behind legalizing identities; while it is recognized as the essence signification of every personal and social identity is really observed as enhanced through recalling (Misztal 2003).

5.2 Memory Recalling Approach Through Heritage

'From the heights of those pyramids, forty centuries look down on us' (Bonaparte 1898). Every place and history has an imperceptible association. At the point at which Napoleon Bonaparte approached the Great Egyptian culture, he detected the previous evidence of an extraordinary human civilization that had totally faded, yet at the same time emerged and symbolized in a tangible proof which is the pyramids. Bonaparte was not blocked by the pyramids, but the embodied history in them.

Places are mostly deemed to help in creating memories and recalling them in complex techniques, as Hayden (1996) argues memory is normally place-oriented. Moreover, places are alleged to ordinarily invigorate visual memory, which may be used as a wellspring of a group-based public history. Its scope grasps various types of endeavor to convey history to the general population that gives a feeling of shared power and provides energy to different social communities to determine their own additional past (Hayden 1996).

Individuals hope to record significant occasions of their life, which they wish to continue recalling later on by various paths. The most vital way is to connect those occasions to specific places or remarkable focal points such as schools where they learned, roads where they grew, and places where they were born (Kamel and Hale 2010).

Thus, actually, every notable and historical occasion is connected or attached in some way or another and either straightforwardly or by implication to specific places. Contingent upon the significance of the occasion over time, subsequently several places are created and promoted to be commemorations of specific historical epochs. In this manner, places have the potential to lead their communities, which may explain why trespassers constantly imbricated public buildings driving their particular patterns and techniques into social places of possessed territories. They applied it through affirming the sovereignty of the new dominating authority and authenticating the ascendancy of intruders through vanquished countries.

For further clarification on the contrast between the approaches to history and memory across the past, Misztal declared that memory underlines the consciousness of the social groups' origins and their identities through time, otherwise the cutouts are defined by history (Misztal 2003).

5.3 Memory Recognition

Harvey (2005) suggests the idea that old remnants could be recognized as a social structured phenomenon in the terminology of life history. This accentuates the vital part that aggregate memory plays in the development, structure and, after that, understanding of cultural heritage.

This concept coincides with Misztal's point of view of relics, in which he believes that the latter is characterized by the predominance of oral memory that connects a feeling through the past, and which blends the legendary and the historical (Misztal 2003). The connection between memory and relics returns to the 'ars memoria,' or the art of the memory, which is referred also as the technique of memory. Misztal (2003) confirmed the significance of the mental image to the memory, emphasizing the debate of Aristotle's which stated that each image is connected to a notion (Misztal 2003; Yates 1966). Thus, each memory has a mental image, and therefore, the framework and recalling for both individual and aggregate memories are demanded by images which are asserted in charge of achieving that claim.

Hayden (1996) emphasized the strength and potential of historical places in determining and characterizing their common pasts. He indicated that the memories of the local people are created by places, and those people participated in their historic past. Moreover, he considered that the common past of locals could be represented by those places to the non-local people (Hayden 1996).

There is a necessity here to note that there are two distinct approaches toward the past which are history and memory, while Misztal (2003) linked the tendency of memory across the past to the 'ritualized activities', which are intended to inspire a well-defined feeling of the past in the present. While she believed that the genetic tendency is considered as a reconnaissance for past occasions, which aimed to promote

the comprehension of these occasions' purposes and outcomes.

Consequently, memory is taken into consideration as an opportunity for safeguarding the past that grants its valued social implications and enhances their cultural significance. That is the reason why debate about memory markers is considered heritage and historical places, as meanings and natural implications have not been ingrained by buildings (Jones 2000). However, they beyond any doubt remain as history observers that perform as memory markers and assist in recalling their spatial memories through history. These historical remnants are supposed to operate as recalling launchers, as the conventional approaches that enhance their memory can promote advanced heritage practices that are considered as the buildings' history perception and convey implications beyond that history.

6 Meanings Guidance

'Meanings, like the environments that communicate them, are culture-specific and thus cultural variable' (Rapoport 1982: 21). As a primary part of any spatial essence, meanings are particularly concerned with social cultures, which are explained through them. Rapoport confirmed that meanings vary as indicated by the adjustments in cultures that are connecting with them, this clarifies why specific letters and images may be misconstrued, whether or not deciphered with an entire comprehension of their authentic cultures. Each place meanings are observed to be ceaselessly developed and in addition to being observed for conveying more than basically only one series of meanings.

Dovey (2010) links the intellectual structure of any place to meanings, as he portrays the place of ideology as the structure of place experience and the procedure by which that the structure of such set of beliefs is established. He likewise expresses that ideology is coordinated with a network of meanings, which develops a series of aids and scenes that help individuals to define and explain the place; otherwise, a place would be pointless and meaningless (Dovey 2010).

In general, the above-mentioned network of meanings is the most important thing that shapes cultures and societies. The assembled context is observed to be the essential milieu for recognizing various strategies of setting up, reproducing, and validating the belief system of place; while places are deemed as the memory warehouses (Dovey 2010).

In the meantime, individuals who create meanings are not decidedly established in items or objects, while, as yet things strongly invoke meanings. The question is, how they inspire or actuate their meanings and lead them and which objects or items that can function better? This brings up a vital issue that prompts another question for heritage preservation practices, nowadays, how enciphering meanings through intended users who can encode them.

As previous experiences particularly influence visions for what is to come, Lynch (1972) considers the power of making an inspired mental future to depend on the capacity to envision the distant present results, which will link and relate the current motivations and feelings into these outcomes.

For the sake of proposing a strategy for prioritizing present results in space, Alexander (1979) clarifies the approach of bolstering intangible activities through the space structure to foresee any variation which could be produced by each modification in any space frame. Along these lines, monitoring any variation can be conceivable, where he depicts the place structure as comprising a sample of duplicated relations which frame the basic texture of any space, especially after its tangible components disappear (Alexander 1979).

Hillier and Hanson (1984) examine and propose a way for analyzing buildings as a conversion of space across objects where the space volumes that are encompassing buildings are formed and composed into patterns. On the other hand, Hayden includes the significance of cooperative work between architectural preservation, public history, and public art for determining and characterizing the city's history, while they are supplemented through a solid community approach which sets up the surrounding context of the social memory (Hayden 1996: 48).

7 Raising Cultural Awareness

The cultural vitality and liveliness of any place could be characterized as the place sense and distinguishing identities which provide access for social cooperation, business advancement, and social connections through the native society (Duxbury et al. 2007; Jackson et al. 2006). Jackson et al. summarized that there are three different levels of social vitality, through the existence of different social activities, cultural involvement, and supportive frameworks or networks. Places which provide several opportunities for social involvements are cultural spots, such as historical centers and theaters, and community places such as libraries, public parks, markets, and festivals (Jackson et al. 2006).

As indicated by Duxbury et al. (2007), culture takes part in enthusiastic urban communities, while cultural spots represent physical resources for cultural participation. Culture additionally composes the heritage estimations of the city. Heritage implies the common ingenuity and outcomes of both man and nature which form the social living conditions (UNESCO 2005).

Moreover, the terminology of cultural heritage is frequently related to materials by past cultural activities that extended from natural to man-made components (Canizaro

2007; Isar 2004). Cultural heritage has two parts, which are known as intangible and tangible heritage (Moreno et al. 2005). At first, intangible cultural heritage is realized as an aggregate of works started by a specific society established on the base of tradition (UNESCO 2005).

This incorporates all types of conventional craftsmanship and identifiable social culture. Considering the contrast of physical and natural heritage, intangible heritage requires the association of a persistent society, keeping in mind, supporting, and enhancing its subsistence wherever people have grown and thrived economically and socially. Urban heritage underpins sociocultural and economic variety and the identity of every community. Every heritage has enduring historical significances, diversity, and difference in the epochal world. This is apparent proof of the coherence and maintenance through time, which might be acknowledged and estimated in their own particular styles (Shamsuddin and Sulaiman 2002).

8 Concluding Summary

Heritage is not only a thing or a place; it is rather a set of cultural procedures, of social activities, which incorporate and recall memory recognition, and a persistent guidance of meanings, which summon specific sociocultural varied paradigms through different places. This procedure gives each place its own value and composes its character and identity, while intangible cultural heritage is considered as the diverse activities which feature the cultural value of various communities.

Cultural activities may be identified by imagining the overlapping framework of heritage conservation, as a procedure which consolidates intangible and tangible complications as earlier discussed. In a common way, these activities are generated and sophisticated in the past and converted, and presumably promoted into the present, through consecutive generations, to mold their identity and features. Subsequently, the distinguishing activities of each community are particularly concerned with the place in any case. However, in the meantime, they can be converted currently by media through various places and by people, in groups or individually.

Despite the fact that the heritage idea, as the previous remnant, is yet informing people in the sense of community, a growing understating of the heritage function in the present day has begun to ascend academically. This defines cultural heritage, specifically, as activities that are occurring, nowadays, influenced by, and gaining from, acquired values, which are clarified in intangible and tangible frameworks. That observation supports modern methodologies of heritage preservation and guidance of heritage places as procedures for exploring additional creative ways.

These approaches should explore several techniques of heritage implementation and consider the conservation of each intangible and tangible heritage, as faces of the same coin, which ought not to be managed independently. Communities should do not latently retain their environment's impacts, yet to some extent they have a significant part in modifying their context by adjusting and then recreating their cultural traditions that usually occur in-between communities.

There are yet diverse approaches for managing the intangible and tangible cultural characteristics through the redevelopment procedure, while improvement variations are unavoidable. In view of the previous literature review, this paper proposes three diverse approaches in redefining cultural awareness; first, the social identity and the sense of place should be distinguished to define their importance and distinction. Second is creating several opportunities for enhancing the cultural participation and increasing the social involvement, which will be achieved through the existence of various activities is considered as the second approach. Third, cultural enlivening should be maintained through the advancement and support of domestic societies.

This paper considers heritage conservation as a procedure to deal with the currently occurring modifications, to some extent this is a system of solidifying the place of the historical image in a coherent manner. Thus, it emphasizes the preservation of the cultural heritage for the benefit of existing and future generations. And, finally, this paper summarizes the emphasizing of the multi-dimensional and interdisciplinary approaches as fundamental aspects in proposing a more extensive solution for outlining the potential of heritage in sustaining and enlivening the cultural awareness and imperativeness.

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Adaptive Re-use in Tunisia Between Remembrance and Contemporaneity

Ons Sakji and Fakher Kharrat

Abstract

This research work is an attempt to understand and analyze the architectural adaptive re-use that is practiced in Tunisia. The main objective is to understand the process of transformation of a heritage building and to determine the degree of relevance of this intervention, according to a theoretical method of objective analysis into the duality of heritage values, as defined by Riegl (Le culte moderne des monuments. Son essence et sa genèse, Edition Le Seuil, 1984): remembrance and contemporaneity. This study relates to adaptive re-use carried out on old buildings, having various architectural typologies, belonging to various existing urban fabrics (historical, colonial, and industrial), having new and various functions which still exist today. We carried out evaluations on the quality of the adaptive re-use of this rich and diverse corpus of study according to fourteen criteria of relevance, which we identified from a bibliographical search and which we classified into two main categories of values of the heritage (remembrance and contemporaneity). The model of analysis developed is characterized by a mixing of scientific methods as MATEA (Model for the Analysis, the Theory and the Architectural Experimentation) which is a statistical method (evaluation of architectural quality) expressing the weighted points of view of the experts (architects specializing in heritage intervention) and an analytical method (media evaluation) expressing the public opinion. For the different architectural typologies, the statistical and weighted evaluation revealed an adaptive re-use which privileges the values of remembrance, in contrast to the media evaluation, which privileges the values of contemporaneity. The results revealed an important divergence of experts' opinions in how they understand certain criteria of relevance and the manner of applying them in an operation of adaptive re-use, to ensure a certain balance between the two values of the heritage. We could also show that the relevance of this intervention depends in particular on its perception through the media. It can influence, positively or negatively, the public opinion and plays a significant role in the urban and social reintegration of the adaptive re-use in order to guarantee the survival of the old and its longevity.

Keywords

Adaptive re-use • Evaluation • Relevance • Criteria • Values • Remembrance • Contemporaneity

1 Introduction

Adaptive re-use is an intervention that gives a second life to abandoned buildings, having lost their initial purposes, by giving them new functions. Adaptive re-use has always been regarded as an inevitable consequence of restoration. It was a simple assignment of premises without a pre-established program and an adequate architectural transformation to accommodate the new function. Over time, this intervention has become a fully fledged practice with its own approach and methodology that takes into consideration the existing constraints and the requirements of the new function. For this, there are several ways of intervening according to the different building typologies and the architectural styles that gives a different final product.

Intervention on the architectural heritage at the international level is well marked at the present time by a contemporary architectural language and concerns different forms of architectural heritage. On the other hand, in Tunisia, the heritage intervention carries a different meaning. Generally, the new function given to the old building is not enough to revive it. The non-compatibility of a new function

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with an existing form, while respecting the cultural and historical identity, very often inhibits the creativity of the architect.

2 Research Question

Adaptive re-use has always been defined by eternal dualities of preservation/creation and old/new. We believe that this kind of intervention has a potential that goes beyond these usual dualities and can lead to other deeper meanings. Indeed, throughout history, there have been several philosophical debates on building conservation and emotion felt in front of monuments. The most important of which is the work of Riegl (1984) who established the polarity of heritage values: remembrance and contemporaneity. These two values have a significance that goes beyond the simple antagonists old and new and which push us to take a new look at adaptive re-use work in Tunisia.

Research on architectural adaptive re-use is necessary for today's architects to assimilate and better understand this patrimonial practice. There is a lack of qualified skilled practitioners for this type of intervention to revive our architectural heritage. Intervening on the old must bring a certain innovation and creativity by a contemporary architectural language, to reinsert the building in its present era. Adaptive re-use guarantees the survival of the old. It may be an alternative for the city of Tunis, which is currently characterized by an increasing and seemingly unstoppable urban expansion.

This research is an attempt to understand and analyze the architectural adaptive re-use that is practiced in Tunisia. The main purpose is to understand the transformation process of a heritage building and to determine the degree of relevance of this intervention according to a theoretical method of objective analysis which contrasts the duality of heritage values defined by Riegl (1984): remembrance and contemporaneity.

Through this study, the understanding of adaptive re-use allows us to evaluate its relevance according to the point of views of the heritage experts (architects specialized in heritage intervention) and public opinion that is formed from the messages conveyed by the media. The research seeks to address the following fundamental questions: How to carry out a relevant adaptive re-use? How is it shaped by contemporaneity or remembrance? How can adaptive re-use guarantee the survival of the old?

We propose that we take an approach to understanding the architectural act of adaptive re-use, while answering the questions already asked in the problematic. At first, we present case studies. Secondly, we present the model of analysis which enabled us to carry out the evaluation of the relevance of the reconversion. Thirdly, we apply the protocol developed on an intervention of the chosen study medium. Finally, we present the results of the various evaluations carried out in support of this research.

3 Case Studies

We opted for a rich and diversified corpus located in the historical core of the city of Tunis (the medina and the city of the colonial period). It includes buildings, with different construction typologies, which have undergone a recent operation of adaptive re-use, reflecting the current trend of this practice. This corpus presents the chronological itinerary of the patrimonial adaptive re-use in Tunisia. This practice originated in the medina and concerned, at the outset, only historic buildings. In the second, adaptive re-use concerned the buildings of the colonial city and then the houses of art nouveau style of the avenues like Mohammed V. And finally, we find ourselves converting buildings with a different typology, like hangars. This path of reconversion traces the evolution of the definition of the architectural heritage which was limited to the monumental historical heritage classified. Then, the heritage definition evolved and included the old buildings with interesting architectural vocabulary. Françoise Choay (1999) stated that "beautiful" buildings are considered formerly as an important heritage. But today that concerns the recent, daily, and ordinary heritage. For this we have chosen:

3.1 The Historic Quarter (The Medina)

Intervention 1: Fondouk El Attarine

El Attarine, which once was a caravanserai for foreign travelers, is located at the souk El Attarine (perfumers market). After nearly forty years of closure, it has been turned into a restaurant and a local craft gallery (Figs. 1 and 2).

Fig. 1 Patio of Fondouk before intervention. Author's photograph

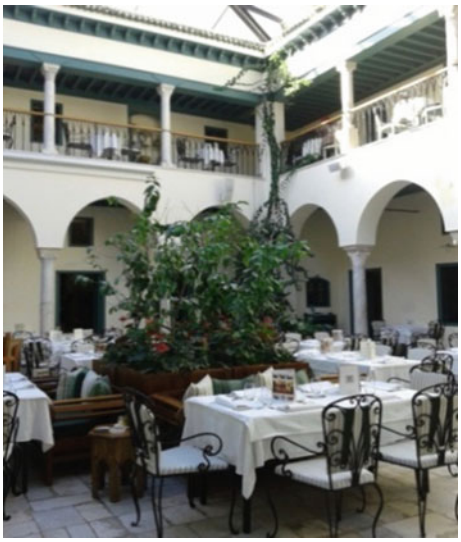

Fig. 2 Patio of Fondouk after intervention. Author's photograph

Intervention 2: Makhzen Dar Ben Abdallah

These former stables of the Dar Ben Abdallah are located in the medina at the Ben Abdallah Street in the vicinity of Tourbet El Bey. It has been converted into a theater occupying the two levels and a garden operated in summer for outdoor shows. The upper floor is composed of a performance hall with a capacity of 50 people, lodgings for artists, and a pocket theater for rehearsals (Figs. 3 and 4).

3.2 The Colonial Architecture

Intervention 1: TIB Headquarters

A master villa, located on Avenue of the USA, has been converted into a bank headquarters (Tunisian International Bank). This old villa, that belonged to Ange Naccache, was designed by the Italian architect Marcello Avena. It has been preserved as it was, converting its ground floor into an agency and the first level housing the headquarters of the general management. The other functions of the bank were installed in a new building built on the same plot (Figs. 5 and 6).

Fig. 4 View of the garden and the ground floor before intervention (Noureddine El Ouerghi)

Intervention 2: Headquarters of the Order of Tunisian Accounting Experts

A former clinic, located on Mohammed V Avenue, designed by the Italian architect Marcello Avena, has been converted into the headquarters of the Tunisian accounting experts. The new function was inserted in the building with an integral restoration of the facades while respecting the existing massing (Figs. 7 and 8).

3.3 Industrial Buildings

Intervention 1: L'étoile du Nord

An old hangar located on Farhat Hached Avenue has been converted into a theater and cafe. This space is covered with

Fig. 3 View of the ground floor after intervention. Author's photograph

Fig. 5 Building after intervention (Archibat no. 19)

Fig. 6 Building before intervention (Abdel-Kefi, Jalel)

Fig. 7 Building before intervention (Khaled Ayed)

Fig. 8 Building after intervention (Archibat no. 19)

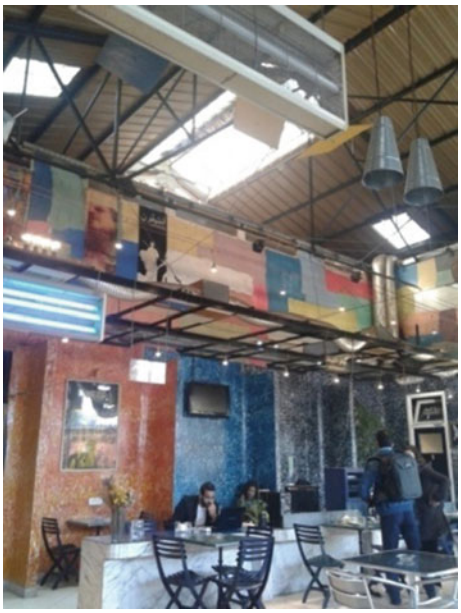

Fig. 9 Foyer after intervention. Author's photograph

a metal framework. It was a car park and a warehouse. The new program is divided into two entities: One part became a removable theater, and the other an Internet cafe (Figs. 9 and 10).

Intervention 2: Whatever Saloon (Kahwet Ellouh)

This old storage shed is located on Lenin Street. The main feature of the interior is a series of exposed timber trusses forming the structure of the roof. The building has been transformed into a multipurpose cultural space dedicated to cultural events (Figs. 11 and 12).

Fig. 10 Hangar before intervention (Noureddine El Ati)

Fig. 11 Interior view after intervention (Wael)

Fig. 12 Interior view before intervention (Wael)

4 Methodological Approach

In order to undertake an objective evaluation of the architectural quality of the adaptive re-use, our approach is a mix of scientific methods and a back and forth between the survey, the MATEA[1] (Models for Analysis, Architectural Experimentation) method and the literature review. We will explain the different phases of the constitution of our model which have been divided into three main stages:

4.1 Step 1: Identification of the Relevance Criteria and Their Classification

The first step in this model was to identify the criteria of relevance necessary for the evaluation of the quality of the adaptive re-use, by decomposing the architectural object into several aspects. Each aspect and criterion of relevance is developed in a set of sub-criteria to furnish the analysis tool MATEA and thus constitute the analysis grid. Through the review of the literature, we tried to divide the fourteen criteria of relevance into two main categories of heritage values established by Riegl (1984).

MATEA, Principles and Weighting

MATEA's approach is to give the architect information and knowledge about the built objects. The principle of this method consists in establishing an architectural assessment that relates to the points of view of the actors/experts (architects, engineers, owners, users, etc.). It consists of comparing the points of view of the actors/experts and appreciating the differences and the variability in time, to construct a representation of the architectural quality and to know the practical terms to open constructive debates based on a scientific study. The weighting in MATEA consists in assigning a weight for each criterion of evaluation according to its importance.

References and Sources of Relevance Criteria

From the international charters and the notions mentioned in some works published on adaptive re-use and symposiums organized about the aspects and stakes of this intervention, we have been able to identify important topics that frame this architectural practice. We were able to develop through the charter of Athens (1931), the charter of Venice (1964), the charter of Washington (1987), and the principles of Reichen (1998), fourteen criteria of relevance re-use which are respect for the immediate environment, the old substance, the development of the construction, the reversibility of the intervention, the distinction between the new and the old, respect of the constructive logic, the compatibility of the

[1]Hanrot (2005).

function with the existing form, innovation and creativity, respect existing decor, responding to building standards, sustainability and scalability, urban quality, social development, and sustainability economic development.

Classification of Relevance Criteria According to Riegl Values

Through a historical overview of the basic theoretical works, we have tried to bring together various theories and practices on patrimonial intervention and to show what they have in common through very varied disciplinary fields and postures. Riegl has highlighted the values of heritage through his book "The Modern Cult of the Monument: Its Character and Its Origin" as well as other historians and practitioners who have enriched this philosophical debate on the notion of values.

The first modern classification of heritage values was established by Riegl (1984), which is the values of remembrance and contemporaneity, welling out the different antagonistic concepts that exist in the architectural heritage object.

4.1.1 The Criteria Belonging to the Value of Remembrance

This first category of value relates to the value that encourages us to preserve the marks of time that refer to the past and appeal to memory.

The criteria of respect of the ancient substance aim to preserve the soul and charm of the building of the past and the respect of its historical identity while preserving the previous states of the different time.

The criteria of respect for the immediate environment have the objective of respecting the perception of the building and its urban image.

The criteria of distinction between the new and the old try to keep the traces of the past by making the difference with any new addition. The same is true for dealing with gaps in a decorative detail and makes a difference with materials or technique.

Respect for the constructive logic that attempts to respect the structure, the volumetry, the composition of the façades, and the existing spatial distribution.

The concern with **the criteria of the compatibility of the function with the existing form** of construction consists in finding the appropriate way to integrate the new function, the necessary amenities, additions, and extensions, respecting the existing spatial organization.

4.1.2 The Criteria Belonging to the Value of Contemporaneity

This second category refers to the present and updates the building after intervention at the present time. The contemporaneity concerns the practical use, the artistic side, and the fresh new and intact appearance of the monuments that will try to integrate it in its present time.

The criteria enhancement of construction cannot be satisfied only with restoration and conservation. It is a concept that uses contemporary means to enhance the value of old architecture while also enhancing the new architecture by lighting the façades, plantings, plant ornamentation, pedestrian ways, street furniture, or signage elements.

The criteria of the reversibility must aim to give architectural re-use a lightness which consists in the possibility of returning to the state before transformation. This implies the use of the means and techniques necessary to allow a dissociation and a distinction of the new from the old.

The criteria of durability and scalability give the intervention a versatility and a certain flexibility allowing the sustainability of the intervention to accommodate a new function with all its requirements.

The criteria of urban quality guarantee the integration of reconversion into its urban environment. It consists of ensuring a good accessibility of the district to facilitate the access to the building after transformation and sometimes ensuring the transport necessary to guarantee the longevity of the function and the building.

The criteria of social and economic development, without these two aspects the building couldn't survive. Its use will disappear over time. A relevant adaptive re-use must draw a new social and economic dynamics in the neighborhood where it is located.

The criteria of innovation and creativity which reveals after the re-use the artistic aspect of the building which could be invisible before the intervention and highlights it at the completion of the works. The innovative and creative contribution of the worker is very important. He must satisfy "the expectation of modern artistic will" as Riegl said by a play of colors, shapes, or materials.

The criteria of intervention according to building standards must be applied to make the building new. It is about giving a new and intact appearance with all the current standards to make a building viable and usable for a contemporary function: electricity, acoustic comfort, plumbing installation, safety standards.

4.2 Step 2: Investigation Protocol

The second step in developing our analysis model is the survey protocol for data collection. Initially, we visited the chosen buildings to observe and discover them. Our visits allowed us to make a preliminary analysis. Then, we conducted an interview with stakeholders or architects for a better understanding of the various conversion activities carried out.

In a third phase, we carried out this survey with architects, who were experts in the field of adaptive re-use and knew the corpus of study and did not intervene in these interventions. This was done in order to have neutral and objective results. This survey is in the form of a multiple-choice questionnaire elaborated according to the fourteen relevance criteria previously identified. There are five choices for experts, each indicating a degree or threshold for the application of each criterion during the intervention. Only one answer is allowed. The interview revealed points that could support and reinforce the precision of our investigation. For this, we have seen that it is more judicious to subdivide each criterion into different sub-criteria.

In a fourth phase, we collected a media corpus consisting of newspaper articles and newspaper concerning the reconversions carried out on the corpus.

4.3 Step 3: Data Processing

The last step was to constitute our analysis protocol by processing the collected data. First, we started with the restoration of the different phases of the adaptive re-use process (Phase 1: study and programming, Phase 2: the architectural act, Phase 3: media reaction). This process resulted in an initial analytical assessment to identify the impression that was conveyed to public opinion through media literature.

Secondly, survey data (survey grid) were coded in the Excel scale (according to MATEA) to develop the weighted evaluation according to the relevance criterion. We used a qualitative scale of values ranging from 0 to 4. For each value, we associate a degree of application of the criterion in the intervention: The value 0 is assigned to the criterion which has been very poorly applied, the value 1 is assigned to the criterion on badly applied, 2 moderately applied, 3 applied well, and 4 very well applied.

This model has been established to objectively appreciate the quality of an architecture or to criticize it. It consists in comparing the points of view of the actors and appreciating the differences to build a representation of the architectural quality. The averages of the values granted help us to appreciate the positivity or the negativity of the architectural

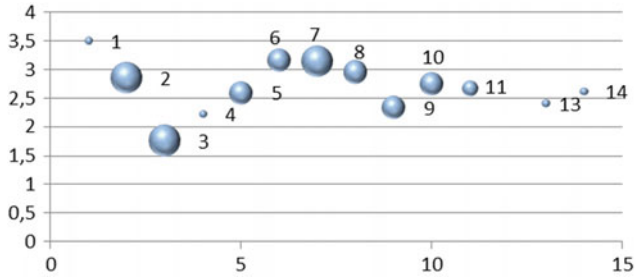

Fig. 13 Variation of criteria weighting

quality. It indicates the convergences and divergences between the points of view. In addition, it takes into account standard deviations which lead us to evaluate the degree of coherence or incoherence between criteria and spaces.

Weighting consists of assigning a weight, given by architects (experts), for each criterion according to its importance in the architectural intervention. The weighted assessment will follow this logic: A bad evaluation and a significant weight sanction considerably the evaluation, a good evaluation and a low weight sanction the evaluation little, a maximum weight and an average evaluation do not alter the evaluation (Fig. 13).

1. Respect for the immediate environment
2. Respect for the ancient substance
3. Enhancement of construction
4. The reversibility
5. The distinction between the new and the old
6. Respect for the constructive logic
7. The compatibility of the function with the existing form
8. Innovation and creativity
9. Respect for the existing décor
10. Intervention according to building standards
11. Durability and scalability
12. Urban quality
13. Social development
14. Economic development.

Thirdly, we performed a weighted assessment based on heritage values by classifying the relevance criteria into remembrance values and contemporaneity values and performing their evaluations according to the previous calculations (the sum of the relevance score scores). Finally, we compared the results of the media assessment and the weighted assessment of heritage values to see the degree of

convergence and divergence between the statistical evaluation of the experts and the analytical evaluation of the media (public opinion).

5 Application of the Analysis Protocol on Intervention Fondouk El Attarine

5.1 The Adaptive Re-use Process for a Media Evaluation

This analysis followed the conversion process presented in the state of knowledge on our research topic. The three phases of this process (study and programming, architectural act, and media reaction) helped us better understand the transformation of each building.

5.1.1 Phase 1: Study and Programming

The first phase consists of a diagnosis of the site, a description of the site, the existing building, and its containers. Fondouk El Attarine is a space devoid of any ornament and was in a state of alarming degradation. The ground floor was used to store goods and rest animals. On the first floor, the rooms were sheltered by the gallery. The large area of the building made it possible to contain two functions, which are those of gallery of exhibition and sale of handcrafts and the restoration function of a certain gastronomic quality.

After establishing the diagnosis, the architect has specified the various works to be carried out to accommodate the new function: The existing structure must be consolidated, the slab of the floor rebuilt, the existing vaults and their stone equipment restored, all wooden elements must be replaced, and some rooms must be enlarged to accommodate the exhibition (Figs. 14 and 15).

Fig. 14 Patio before intervention (Ghazi Ben Ismail)

5.1.2 Phase 2: Architectural Act

The second phase of the process concerns the architectural act, which explains the adequacy of an existing form with a new function, while presenting the new spatial organization with respect to the existing morphology.

The architect chose two intervention strategies. The first is an intervention which consists of inserting the new program in the existing building, which adapts to the new use with certain transformations, such as the removal of certain interior walls to enlarge the interior spaces of the rooms but without touching the outer walls.

The second intervention strategy consists of adding a new or contemporary architectural element, such as the canopy that was added to cover patio and the extension of the second partial floor, which was added to respond the need of the new function's program (Figs. 16, 17, and 18).

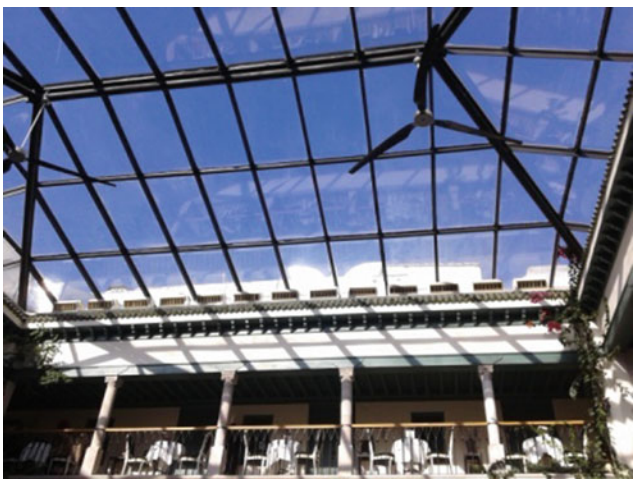

Fig. 15 Canopy after intervention. Author's photograph

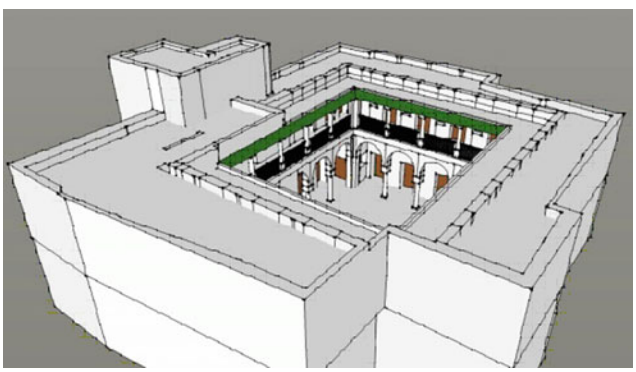

Fig. 16 Massing of building before intervention

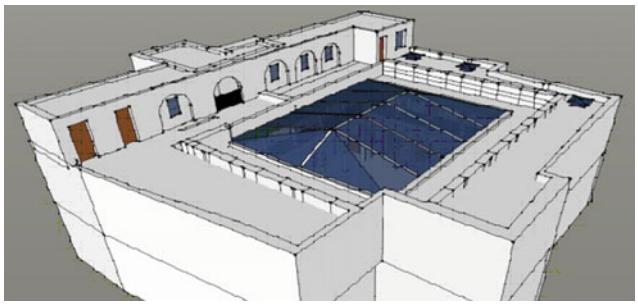

Fig. 17 Massing of building after intervention

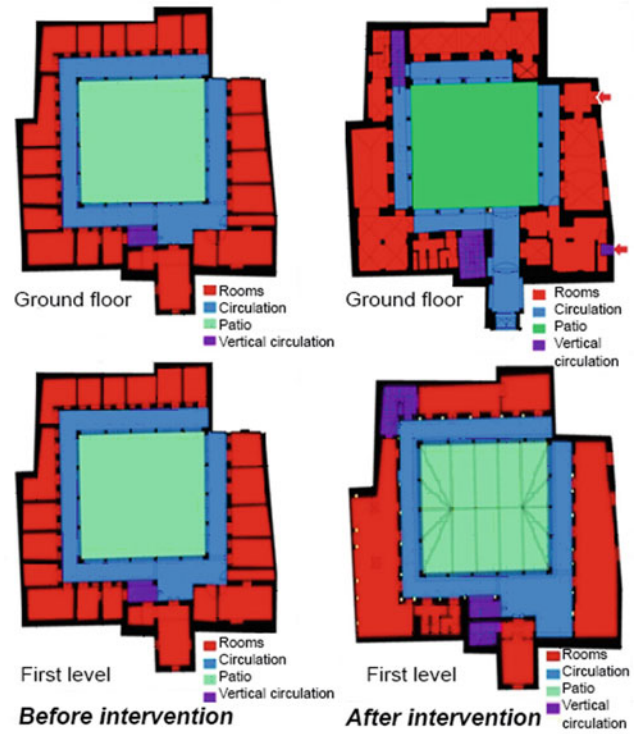

Fig. 18 Graphics documents of Fondouk El Attarine

5.1.3 Phase 3: Media Reaction/Public Opinion

The final reception of the building is accompanied by a criticism of the intervention. The analysis of this phase is based on representations of the building in the media discourse and in the written papers. This analysis is preferred to public inquiries and interviews with only users or visitors, because the media influence gives us a general idea of public opinion.

The last phase is devoted to the presentation of papers published on the converted buildings and that have influenced public opinion (positively or negatively) by emphasizing some aspects more than others. A comprehension of this vision has helped us to better identify the degree of relevance of architectural re-use done and seen with the population look.

Table 1 Media evaluation of Fondouk El Attarine

Papers	Developed values	Values that take precedence
Paper 1 (book)	Remembrance	• Values of contemporaneity
Paper 2 (two Web sites)	Remembrance	
Paper 3 (five Web sites)	Contemporaneity	
Paper 4 (Web site)	Remembrance	
Paper 5 (Web site)	Contemporaneity	
Paper 6 (Facebook)	Contemporaneity	
Paper 7 (two Web sites)	Contemporaneity	
Paper 8 (review)	Remembrance	

We carried out a media evaluation by analyzing the papers published on the adaptive re-use of the Fondouk El Attarine as a craft restaurant to express the heritage values that have been highlighted. This media corpus is composed of papers that have appeared in the press, electronic journals, architecture reviews, and gastronomic sites. We have noticed that there are several sites that talk about a new use of the Fondouk, a new gastronomic function, and a luxury craft creation allowing the values of contemporaneity to prevail over remembrance (Table 1).

5.2 Evaluation of the Interventions According to the Criteria of Relevance of the Adaptive Re-use

See Fig. 19.

5.2.1 Reading the Graph

The weighted evaluation of enhancement of construction criteria has a negative peak. A maximum weight of 4 and a lower than average rating significantly penalize the intervention.

The following criteria, respect of the old substance, the compatibility of the function with the existing form, the distinction between the new and the old, respect of the constructive logic, innovation and creativity, respect of the existing decor, intervention according to building's standards, and lastly the criteria of durability and scalability, have a significant weight and an evaluation score above the average which does not penalize evaluation.

A low weighting for the criteria of urban quality, social and economic development, respect for the immediate environment, and the reversibility of the intervention penalizes the evaluation a little.

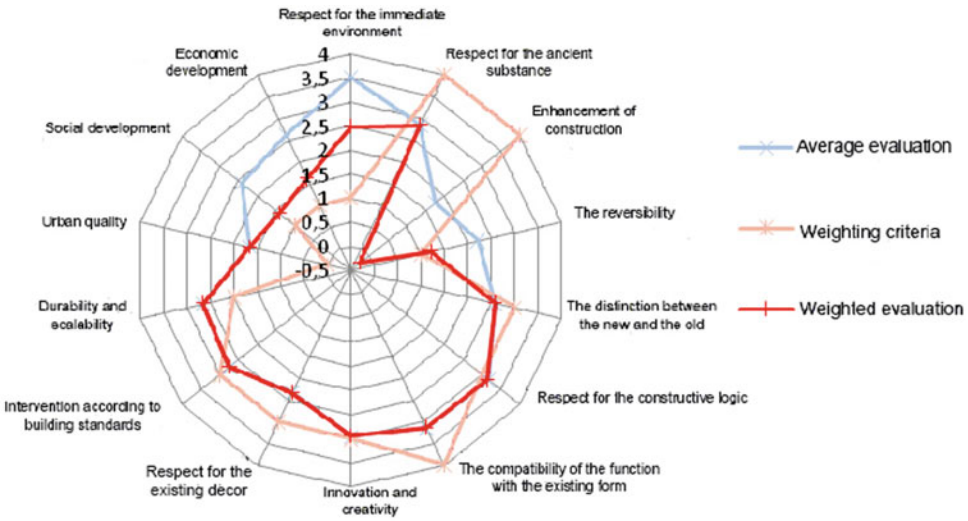

Fig. 19 Weighting evaluation of Fondouk El Attarine according to the criteria of relevance of the adaptive re-use

5.2.2 Interpretations

According to the experts, the negative weighted assessment of enhancement of the construction is due to the difficulty of finding this place in the medina and to a lack of media communication about the re-use of this space. And some think that the contemporary intervention is quite contrasting with the existing building.

A majority of the criteria were well respected in view of their above-average evaluation scores. This shows the know-how of the architect intervening and the interest he has taken to respect the existing morphology by adopting it to the new function while keeping the authenticity of the premises.

The social and economic criteria have two satisfactory average scores, but their negligible weightings have penalized these scores. This shows the experts' lack of interest in these two criteria, which are very important in a patrimonial operation. They are reliable measurement tools for the success of the conversion intervention.

Economically, this adaptive re-use ensures fixed jobs and a continuous cash entry given the notoriety of its dual function of restoration and sale of handcrafts. It created a certain economic activity in the souk accompanied by a new attendance of the neighborhood.

Urban quality has not had the average given the difficult access to the medina; the complexity and size of its street networks do not give any freedom of intervention.

The low weighting for the reversibility criteria has penalized it, yet reversibility is an important concept that ensures the possibility to return to its pre-conversion state. In the future thus ensuring its longevity.

5.3 Evaluation of the Interventions According to the Values of the Heritage

Figure 20 shows that the values of remembrance are superior to the values of contemporaneity for the weighted evaluation of Fondouk El Attarine. Yet the contemporary touch in this space is clearly visible in terms of furniture, lighting, and the transparent structure that covers the central patio. This contemporary addition has given freshness and novelty to this space, which at first did not present any ornament.

The experts find that the values of remembrance were better favored. This is due to the thoughtful and well-studied contemporary additions that have succeeded in highlighting the stone walls, arcades, and columns that frame the patio.

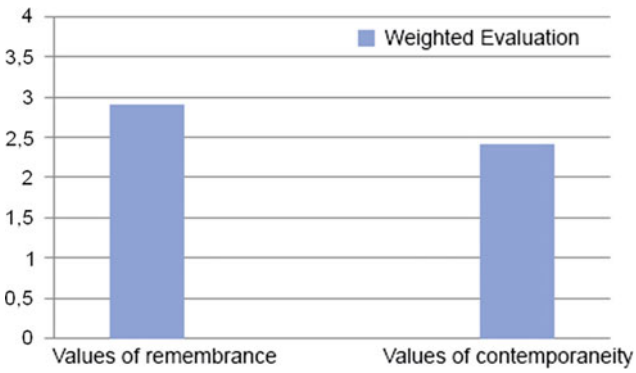

Fig. 20 Evaluation weighted according to the values of the heritage of Fondouk EL Attarine

The weighted evaluation of Fondouk El Attarine is a positive assessment for both categories of values.

5.4 Cross-referencing of Evaluations: Divergent Evaluations

We compared the results found in the media assessment with those of the evaluation of the conversion interventions according to the values of the heritage. We recall that the media assessment is the culmination of the analysis of the conversion process that comes after the completion of the work. This analysis constitutes a kind of evaluation of the relevance of the architectural intervention at the media level which influences and contributes enormously to the constitution of the new image and the new representation of the converted place.

For the conversion of the Fondouk El Attarine, no media campaign was carried out before and after the work to emphasize the history and the old architecture of the building and announce its future vocation. A small number of articles refer to architectural transformation. A media focus has been placed on the success of the new function which perfectly maintains the living space with high attendance. The media speaks, essentially, of the values of contemporaneity. Statistically, according to the experts, it is the values of remembrance which are far superior to the values of contemporaneity. We believe that these conflicting results are due to the difference in the level of knowledge between the heritage experts and paper's authors.

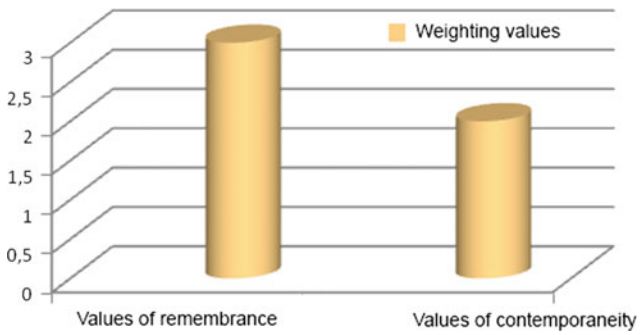

Fig. 21 Hierarchy of heritage values by weighting

6 Generalization of Results

6.1 Hierarchy of Riegl Values

This graph shows that the weighting of the remembrance values is more important than that of contemporaneity. Yet the number of criteria belonging to the value of recall is less than that of the value of contemporaneity (Fig. 21).

This inequality in weighting values informs us about the current trend of the adaptive re-use, which consists in privileging remembrance values. According to Riegl, these two values must have the same importance when receiving the final product. Moreover, the research that has been developed in recent years has promoted the value of contemporaneity in remembering, because it brings the heritage that has been converted back into the present.

6.2 Different Typologies and Same Results

Table 2 summarizes the results found in the media assessment and weighted assessment based on heritage values. The public's view of these architectural and functional transformations does not conform to the opinions of architects and heritage experts.

The majority of papers speak of the place through the activity and the events that take place there, while few of them highlight the architectural intervention (the authors are architects). Thus, public opinion is formed from the activities and events of the second assignment of the building and not from the architectural adaptive re-use.

The discrepancy between the media assessment and the assessment of heritage values is due to the difference in the level of knowledge of the paper's authors and the heritage experts. This also goes to the nature or specialty of the newspaper or magazine in which the paper appeared. A review of decoration and architecture highlights the

Table 2 Summary of the results of the evaluation of the three typologies

	Values that take precedence	
Corpus	Media evaluation	Evaluation according to heritage values
The historic quarter	Contemporaneity > remembrance	Remembrance > contemporaneity
The colonial architecture	Contemporaneity = remembrance	Remembrance > contemporaneity
Industrial building	Contemporaneity > remembrance	Remembrance > contemporaneity
Conclusion	Contemporaneity	Remembrance

architectural intervention, but the other media just cite the first function, whereas they highlight the new function.

Adaptive re-use in Tunisia is not enough integrate in the social and urban life. Perhaps, these recent conversions do not create a new urban image of the architectural heritage offering an interesting subject for the media.

7 Conclusion

To conclude, we believe that the objectives of this work are achieved. We understand better the architectural re-use that is practiced in Tunisia and its heavy tendency which privileges the values of remembrance over the values of contemporaneity, thanks to a model of theoretical and objective analysis. This allowed us to prove that adaptive re-use guarantees the survival of the old, but does not ensure its longevity and its durability over time. A relevant adaptive re-use depends on its values of remembrance and contemporaneity which must have the same weighting. Its relevance depends in particular on its media coverage so that the conversion can be better integrated at the social and the economical level.

This research on the notion of values on architectural adaptive re-use, between experts and public opinion, makes us understand that there is a problem of divergence and incoherence of evaluations which is essentially centered on the values of contemporaneity. We can understand that there is confusion in the understanding of these values. Probably, these two values of Riegl (1984) need to be redefined in order to take new forms that could give greater clarity to this research.

We believe that this study has opened up new horizons for this research axis, which leads as to the elaboration of a software based on the analysis model developed. The latter can conduct evaluations on conversion projects before realization. We can also carry out a study on a unique constructive typology, while expanding the corpus to refine more the results found.

We can improve our model of analysis by pushing the media assessment that can yield interesting results with a richer media corpus. The social and economic aspects of retraining could be carried out in a full-fledged study involving other disciplines. These two aspects could constitute a tool for assessing the relevance of architectural adaptive re-use. A study could be done only on the contemporary additions in adaptive re-use interventions to see its impact on the image of the heritage in Tunisia and how this addition could play in favor of the relevance of the architectural adaptive re-use.

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Reviving Sudan's Ancient History and Tourism

Alaa Abbas, Fatimah Abbas, and Aida Nayer

Abstract

Reviving Sudan's ancient civilizations has attracted people's attention in the last two years, especially as the public have realized the importance of international tourism toward developing Sudan's potential strategic importance. Heritage sites have suffered from neglect although currently the existence of a large number of pyramids has been recorded in Sudan. More and more visitors started to come to Sudan for both academic research and tourism. This research paper highlights Sudan's potential sites for touristic development, based on conservation of existing pyramids, as well as remotely placed antiquities related to Kush. Journeys to the Nile Valley have uncovered the cultural integration between Sudan's civilizations Napta, Karma, and Kush and the civilizations of Aksum in Ethiopia and the Egyptian kingdoms. The Kush Kingdom is one of the most influential cultures in the world, which was not only dominant over many countries, but had astronomical knowledge and beliefs. Finally, prototypes of architectural projects built in both the Bagraywiah area of northern Khartoum city and Meroe city are the celestial village and the cultural library, respectively. They are the starting point for high-quality projects dedicated to serving tourism on a national scale. These ancient relations and unique types of knowledge will be emphasized in the projects through building design and functions to reveal the identity of the archaeological sites.

Keywords

Sudan's ancient history • Astronomy • Alignment • Kush • Pyramids

1 Introduction

The country of Sudan has witnessed remarkable archaeological discoveries in the past two centuries. Along the Nile River lie forgotten civilizations that contributed to human knowledge and development. Napta, Kerma, and Kush were the essential landmarks of Sudan's architecture, art, and culture. These ancient monuments include a group of palaces, pyramids, houses, and sometimes artifacts that were deeply hidden to a point that some citizens found small sculptures while digging to build their house's foundations. The ancient monuments were subjected to massive destruction and thefts, along with some major events like the high dam construction that drowned the city of Halfa and the national ignorance of the monuments in addition to the time factor.[1]

Along with the ancient civilizations, there are one hundred tribes in Sudan, representing the country's diversity. Each tribe has its language, customs, and heritage which reflect the cultural traditions in Sudan. The tribes are different regarding origins and religion. Arabs and related Ethiopian tribes in the east, Nubian tribes in the north, Fong, Fore and many other tribes in the west, Dinka and Nuer in the south of the country and lastly the country's center where everybody is gathered and connected. The traditions and costumes of these tribes are not well known, not to the world, but even to some Sudanese people. Tribal costumes and rules are essential to an extent that they can overcome administrative procedures in most cases.[2] Being aware of

The original version of this chapter was revised: The corresponding author and the authors' sequence were incorrect. This has been changed according to the authorship change. The correction to this chapter is available at https://doi.org/10.1007/978-3-030-10871-7_23

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[1]Masoud (2002).
[2]Farah (1982).

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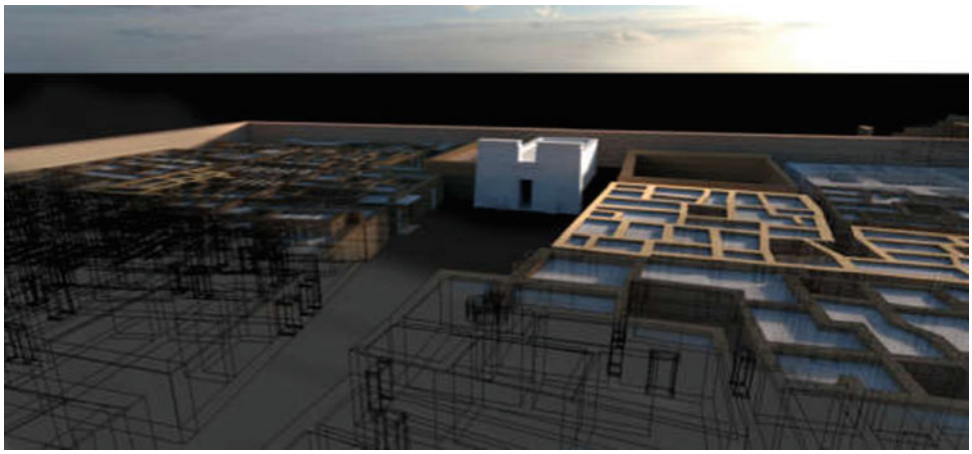


Fig. 1 Reconstruction of Hamadab monuments done by German Archaeological Institute showing the grid pattern

such different contexts is necessary for foreigners visiting Sudan and Sudanese living in cities. Some national plans about reviving the ancient history and tourism, like Sinnar city project, as the capital of Islamic culture, and promoting the Port Sudan town as a new destination for tourism. These are gaining some acceptance from the public, but still, they are not strong enough for worldwide competition.

2 Literature Review

"One of the issues discussed, which current and future archaeologists will always face, is the degradation of the ancient buildings especially that their primary building materials were mud and burnt-brick."[3] Climatic factors affected the monuments especially as most of them are built in the desert or Butana region, the rainiest area in the country. Reviving Sudanese antiquities was supported by restudying the old researches of Friedrich William Hinkel about the Bagraywiah pyramids that have a more significant impact on the historic site. Friedrich Hinkel is one of the most important researchers in Sudan; he spent four decades there and moved between many archaeological sites. Some of his famous projects were designing Sudan's national museum and supervising the transportation of Nubian temples from the old city of Halfa to save them from drowning in Nasser Lake.

There is a common misunderstanding about the Sudanese and Egyptian monuments; the public consider them sometimes as one civilization. The fact is that Sudanese antiquities are inspired by the Egyptian civilization in many cultural and architectural aspects. Sudan and Egypt were one country at many times in the history; the first time was when King Taharqa invaded Egypt and enrolled it under Kush rule (640–620 B.C.) according to *Dr. John Henry Clark's* article, "Black Pharaohs: The Kings of Kush-Egypt's 25th Dynasty," 2017 (Cambridge University Press, 2017).[4] The second time is the period of the Ottoman Caliphate, when King Farouk and his Father Fouad were the kings of Egypt and Sudan.

In a comparison between Egyptian and Kush civilizations, the Nubian buildings were recognized by their smaller scale and irregular grid lines, see Fig. 1, except for the religious temples. They had less decorative motifs but more focus on the structure and the orientation toward the main temple. These architectural facts are informative due to the destruction of significant parts of the monuments, but there is still a possibility in the future of finding more artifacts with more details.

Nubia refers to the land of gold, the northern region that starts from Khartoum reaching Aswan in Egypt, is full of gold and other metals. The Kush was famous for mining and creating golden sculptures. This fact will affect the locations of future building projects in the northern region, as these should be far enough from any possible archaeological or mining sites; see Fig. 2a, b. One of the relevant events to Kush pyramids is Giuseppe Ferini robbing the buried treasures. He was a physician with the Italian military; he destroyed the top of the pyramids because the existing gates are false entrances, while the real ones are hidden under sand dunes; see Fig. 3.

2.1 Academic Supervision

Together with the touristic orientation of our research, we emphasize the importance of cooperating with academic institutions supervision over the mission of reviving Sudan's heritage. Protecting the traditional heritage with the help of the government and the international organizations is essential to develop knowledge and conduct more explorations

[3]Schellinger (2017).

[4]Jack (2016).

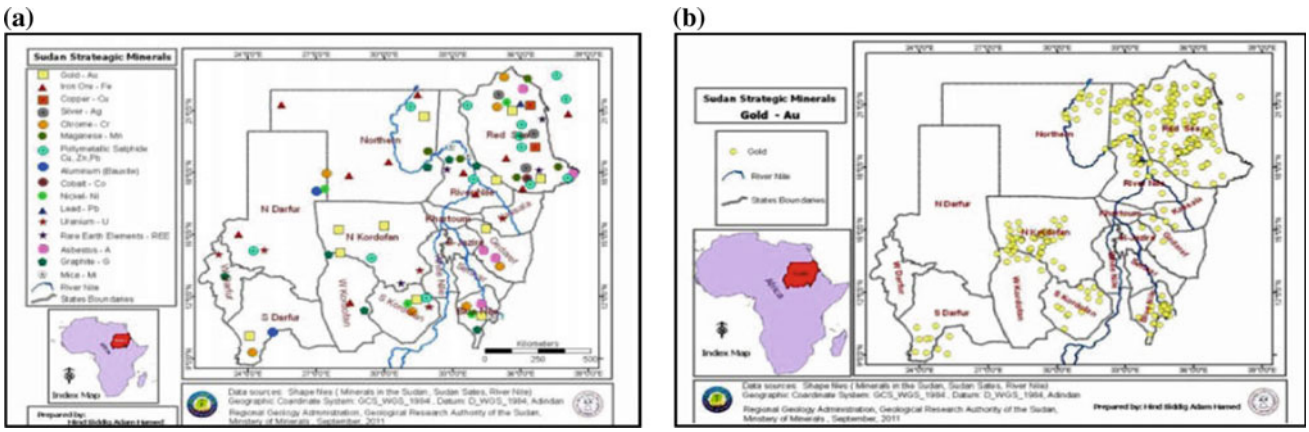


Fig. 2 **a** Metal distribution map according to Ministry of Minerals and **b** Gold distribution map according to Ministry of Minerals

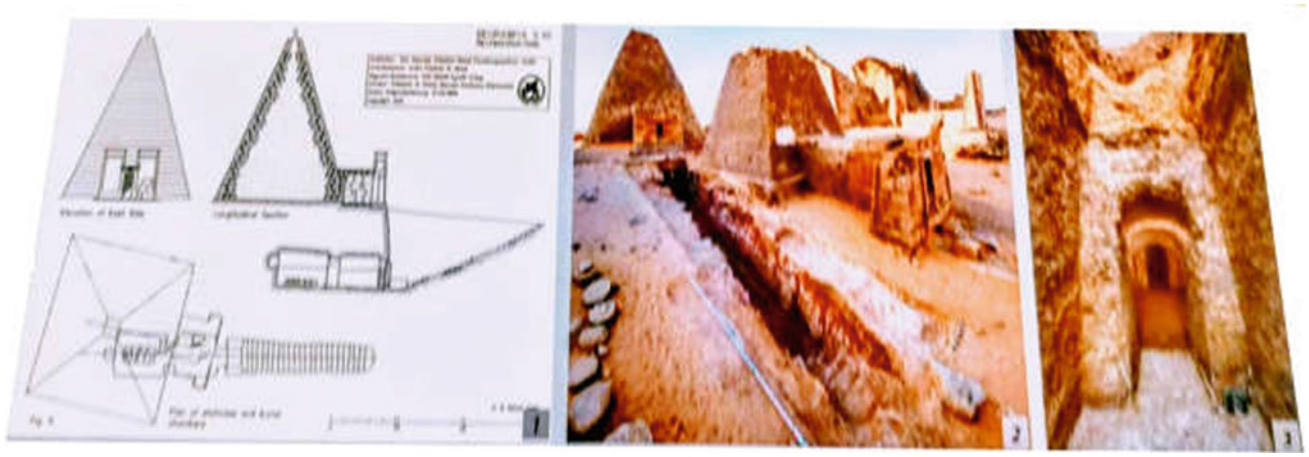


Fig. 3 Drawings and pictures showing the pyramid's rear entrances

Fig. 4 University of Khartoum, Khartoum

into ancient civilizations.[5] The academic environment in Sudan was started by establishing Khartoum College and later Khartoum University by the British Lord Kitchener in 1898; see Fig. 4. There is a group of cultural centers established by Sudanese intellectuals in the last century. One of the critical cultural centers is Abd El Karim Merghani's Cultural Center which was established in 1998. Abd El Karim Merghani's watchword was "unity through diversity." This cultural center has gained all Sudanese community categories respect and support. The primary goal of this cultural center is to cooperate with other cultural centers in Sudan and internationally to provide with possible help for students and researchers like a computer, Internet, two libraries, exhibitions, lecture hall, print and copying facilities.

There are various extended cultural heritage centers in the studied areas around Sudan that were established according to the cooperation between the Sudanese government and other countries such as the British Cultural Center; see Fig. 5. It was found in 1948, it offers courses in the English language, and it has a library, conference auditorium, and film show. The French Cultural Center provides French language courses, library, film show, seminars, video club, and exhibitions. Also, there are many cultural centers like German, Iranian, Libyan, Iraqi and Greek cultural centers which

[5]Choul (2015).

Fig. 5 British Cultural Center Khartoum

provide different cultural activities for people. This variety of nationalities is adding the proper context of knowledge exchange between Sudan regions and the outside world.

3 Building Prototypes for Saving the Heritage

3.1 The Celestial Village

The project mission is a full dedication to ancient Kushite practices and bringing back Sudan to the world map of tourism. The project objectives are first social in integrating local Sudanese with the historic sites and making them more aware of its importance. Connecting the civilizations along the Nile River and emphasizing the inspirations between all of them is one of the leading project goals. The second objective is targeting the ancient designs of Kush palaces and temples with their decorative motifs to spread these to the field of architecture. The Kushite designs include some sustainable aspects of using 1-m-thick walls and using local building materials; see Figs. 6 and 7. Finally, the economic objective, in considering tourism as a primary source of income for Sudan as agriculture, was always the main source of national economy.

3.2 Celestial Village Components

Celestial refers to space and astronomical phenomena, and I named my project by this name referring to the astronomical spatial alignments of Kush Nuri pyramids in Marawi city in the northern region. According to UNESCO research, it was found that Nuri pyramids are aligned to the exact cardinal directions. A 3500 BC years old design of precision. The project components are inspired by the historical materials and nature of the Kush.

Fig. 6 A Nubian column

Fig. 7 Nubian vaults as the main design

- The extended clear skies substantiate the proposed observatory in the deserts. This will enable visitors to know more about Kushite contributions to astronomy. It will be open to researchers and amateur astronomers.
- An art craft center to enrich visitors, minds and senses about forgotten art pieces. Visitors will have the chance to learn how to create Kushite artistic fragments, like sculptures and

paintings. Mastering the art philosophy and the meanings of Meroitic language and signs is a key objective.

- A Kushite classical motel. As the project proposed site is in the northern desert, next to one of the archaeological sites, such as the Bagraywiah pyramids, the project will need a motel. Hosting Bagraywiah visitors in storytelling spaces to reconstruct Kush reality, while boutique motels will form the best approach. For the better experience, the motel architecture will imitate ancient Nubian building features, such as underground structures, the different type of columns, Nubian vaults.
- A planetarium. This will show modernity with the local environment. It will be situated as an entertainment facility to attract all types of tourists of all ages. See Fig. 8 for zones and functions.

3.3 Project Context and Design

There were three proposed locations for the project next to three archaeological sites, Jabel al-Barkel in Marawi city, pyramids of Bagraywiah, and Musawwarat monuments. According to some criteria associated with observatories standards, the Bagraywiah area was chosen; see Fig. 9. The site will be located next to the Bagraywiah pyramids, which is 237 km from the capital. It is a desert space with some tribal villages and small motels, gas stations, and all highway necessary services. It is already supplied with public services like electricity, water, and Internet which makes it affordable. It has a low population density with less light pollution, which is suitable for astronomical observatories, as per Figs. 10 and 11.

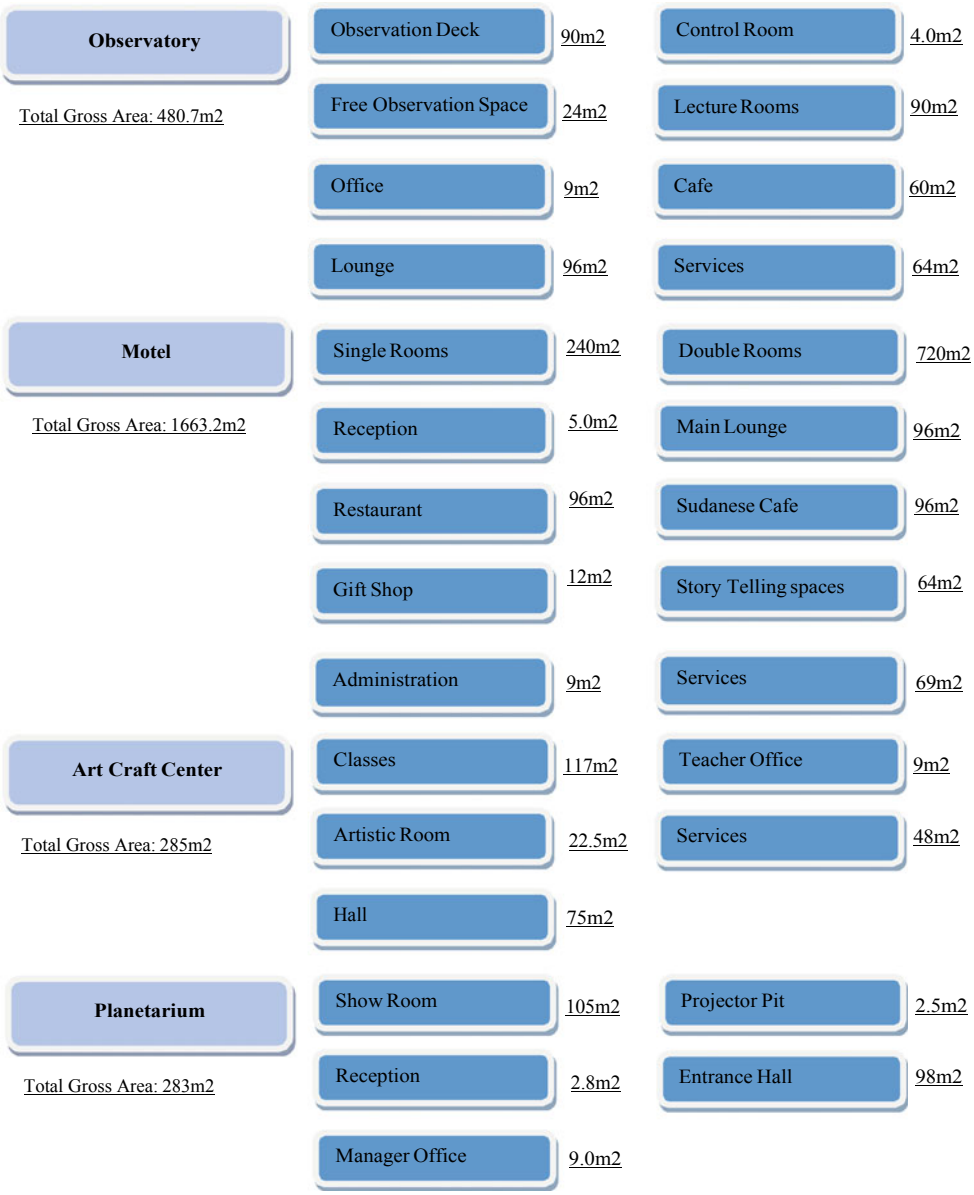


Fig. 8 Zones and functions

Site analysis:	Transportation	Clear skies	Proximity to the capital city	Ready public services
Bagraywiah pyramids	By cars or buses using the highway	Almost clear skies and small buildings exist in the area	237 km from the capital	Ready with electricity and water systems
Musawwarat	By cars or buses using the highway	Less clear skies as the site is closer to Marawi Airport	180 km far from Khartoum	An area in the middle of the desert with no services
Jabel al-Barkel	By cars or buses using the highway	Less clear skies as the site is closer to Marawi Airport	325 km far from Khartoum	The location is close to the city of Marawi with ready infrastructure

Fig. 9 Criteria for choosing the location

Fig. 10 Context of the project, *Kush pyramids, Bagraywiah area*

The latest statistics about Sudan's annual number of tourists was 799, 644 persons in 2017 according to CEIC data. Tourists' accommodation varies in Sudan depending on the region; it is to a high standard in the capital city and low to not existent in the villages. Western tourists usually came in the winter time, and they came from different routes of travel. They are coming through the Khartoum International Airport, or they come from the Ethiopian borders going north to Egypt, or the opposite direction. The routes along the highways include more views and enable tourists to visit all the archaeological sites along the way, and sometimes visitors come biking. Different types of tourists create different kinds of functions that can enrich the project.

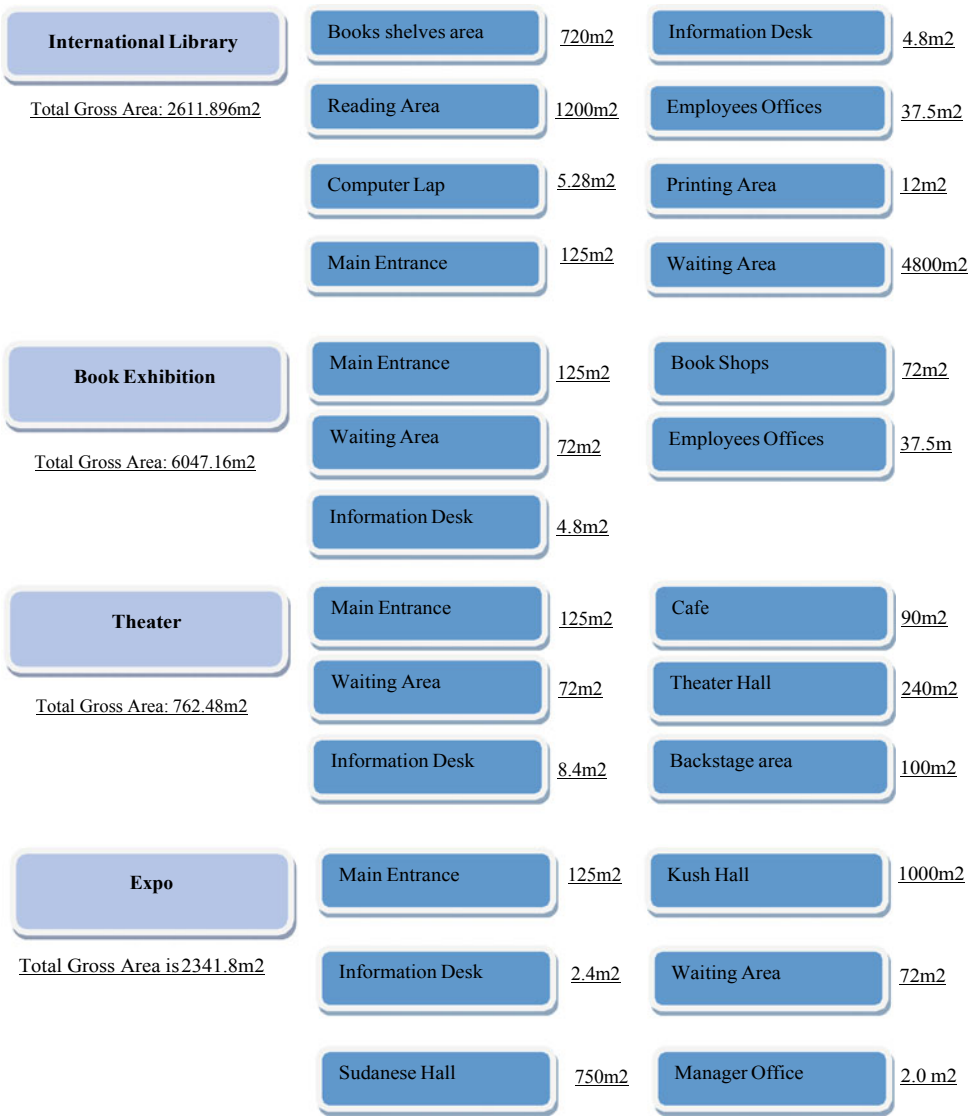
The site selection criteria considered a 1 km distance from the highway to reduce noise and light pollution. The astronomical observatory as the main building will control the amounts and directions of light fixtures in the project and make it the minimum possible. Using low-pressure sodium lamps and 50°–60° in lamps orientation to decrease light emitted above the horizon line is good practice, according to a practical guide for outdoor lighting. Parking will be calculated as one parking lot for every three persons. The land area is 15,000 m^2 with a 30% building footprint.

3.4 The Cultural Center

The Cultural Center of Kush mission is to make a massive amount of information available for people, to enhance tourism and the economy and to reflect the diversity of Sudan. The objectives are economical, in providing a source of income for Sudan because it will attract tourists.

Fig. 11 Project site and the important surrounding, *Bagraywiah area*

Fig. 12 Program of each department



The Sudanese Ministry of Investments is supporting this aim by encouraging investments in many touristic projects, e.g., Halfa Valley touristic village. Educational projects, such as the cultural center of Meroe, will make lots of information available for the people of Sudan which can improve their educational level, which will play a leading role in improving the community, integrated with the Ministry of Higher Education and scientific research goals. Economically, it will create job opportunities and bring knowledge of other nations. In the touristic aspect, according to the Ministry of Tourism and Antiquities, the cultural center of Meroe can help in using the touristic resources of the country to **enhance** tourism.

3.5 Cultural Center Components

The main components of this project are a First international library which will make all the traditional and modern information resources available at a state of the art level. Exhibitions for international books will be designed to be an appeal to world publishers. So, they will avail their products and for local and regional publishers as well. Also, a theater for all artistic activities to be developed. Finally, an expo, will be divided into two departments: The first will present the way of life of the Kush kings, and the second will display the heritage of Sudanese tribes. Figure 12 shows the program of each department.

3.6 Cultural Center Context and Site

The site is located next to the Jabel al-Barkel monuments in Marawi city. The site is 20,000 m^2, and it has a footprint of 58%. Marawi is famous for the Amun temple in front of the mountain, the Nuri pyramids, and a group of other monuments including a cemetery. Marawi city is divided into two parts, eastern and western to the Nile, and the airport location is on the east bank. The route from the airport to the area will allow the visitors to get a full view of the city. Marawi city was chosen as my project site because it is a simple place, but yet prominent with the new airport, new Marawi dam, groups of different monuments, and massive agricultural projects; see Figs. 13 and 14.

Fig. 13 Project site next to Jabel al-Barkel

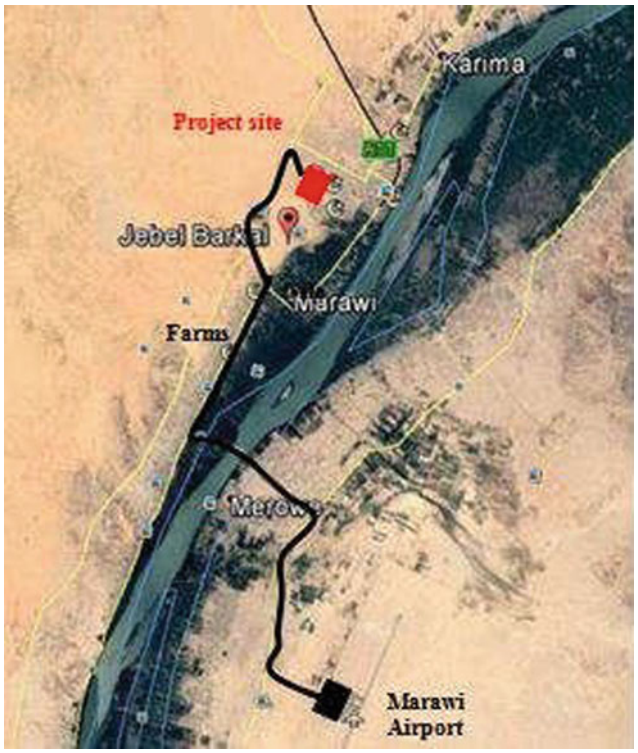


Fig. 14 Route of transportation from the airport to the site

4 Conclusion

In this research, we have raised the issue of forgotten civilizations that in 3500 BC were the strongest in the world. The Kingdom of Kush ruled an area from Ethiopia to the borders of what is now the state of Palestine (Jack 2016). The ancient monuments that remain were subjected to a series of high and low acts that led to their preservation sometimes, or total disappearance in other cases. As an approach to save what is left from the heritage, we adopted a way of building tourism attraction projects next to critical archaeological sites, to attract more visitors and national attention. There are both obstacles and motivations regarding these projects. The motives are emphasized by the higher number of tourists coming to Sudan annually, despite its economic and political instability. Incentives are also shown in the discoveries appearing every day from academic explorations. Regarding the obstacles, the principles of these is the hot, dry weather of the northern region of Sudan, where most of the monuments are located. Another problem is the lack of tourism facilities, but this creates an opportunity for new projects and investments.

Some inspirations from the ancient antiquities, or other case studies with the same concepts, have influenced the design of the prototype. As Nubians used irregular patterns in their houses and symmetrical designs in the temples, some storytelling spaces in the motel-like main halls, or the cultural center, will follow the same strategy. Taking inspiration from boutique hotels as an example of giving tourists a different experience of a historical period. Recalling the exploration journeys, mommy's, mazes, carnivals to worship the god of the sun (Amun) and many other Kushite characteristics will enhance the project and excite people to try new activities. On the subject of new business opportunities, camping in the open desert air and stargazing events are important possibilities.

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An Architectural Project of Giovanni Maria Falconetto Discovered During the Restoration of the Alvise Cornaro House

Maurizio Berti

Abstract

The restoration of the courtyard of the house of Alvise Cornaro was carried out between 1983 and 2000. During this long period, the author produced several studies and projects, regularly debated with a high-profile international scientific commission. The house of Alvise Cornaro, in Padua, was reformed between 1524 and 1560 ca. and is one of the first architectures of the Roman Renaissance according to the Vitruvius canons built in northern Italy. This architecture has long established its reputation as a place for comedies and small concerts due to the presence of two buildings of great architectural quality: the Loggia and the Odeo. Based on observations and measurements, however, the restoration programme allowed us to recognize that architecture corresponds to a unitary project inspired by a kind of the domus canonized in the Vitruvius architecture treatise. *The paper presents arguments and conclusions of this case study.*

Keywords

Giovanni Maria Falconetto • Alvise Cornaro • Frons Scaenae • Theatre • Domus • Vitruvius

1 Frons Scaenae of Classical Theatre

There is the idea that the humanist Alvise Cornaro had built a theatre, or part of it, the *frons scaenae*, in his house in Padua to represent the comedies of Angelo Beolco called Ruzante. The idea of a theatre building, inspired by the classic Roman model, was born from the interpretation of the *Elogio* (Cornaro and Milani 1983), a short writing by Alvise Cornaro that was read during his funeral. According to the most widespread opinion, this part of the theatre coincides with the beautiful Loggia in the humanist's house and would be one of the first examples of a theatrical architecture realized in Italy in the Renaissance, to the design of the architect Giovanni Maria Falconetto.

The idea of a special architecture for the theatre in the house of Alvise Cornaro was elaborated by historians during the second half of the twentieth century, with research on written sources and in Venetian areas, where Cornaro and his protected Ruzante and Falconetto lived and operated. Among those who did research on the stone theatre mentioned in the *Elogio* were Mortier (1925), Lovarini (1965), Menegazzo (1964), Fiocco and Cornaro (1965), Zorzi (1967), Alvarez (1980a, b), Milani (1983), Calendoli (1985, 1995). But archive studies and the explorations made in the area between the hills of Este and the valleys of Polesine revealed no traces of stone scenes for a building suitable for theatrical performances.

The theatre in the Cornaro house seems to be a topic considered especially by scholars of theatrical literature interested in Ruzante's work. However, Ferguson (2000), more than any other, questioned the existence of an architectural connection between the Cornaro Loggia and Ruzante's representations, as some scholars before him considered, including Zorzi (Zorzi 1967, 1982).

Ludovico Zorzi, a fundamental reference for studies on Italian theatre, wrote a lot about the topic of the Loggia in the courtyard of Cornaro's house. Zorzi tried to prove that it was a proof of Renaissance reconstruction of the *frons scaenae* of classical theatre. So Zorzi (1982, pp. 9–10) writes:

It is difficult to say when the upper floor is added over the loggia. Above all it is hard to determine whether the monument has been designed from the appearance in its present form and executed in two successive times, or if it has been elevated (with the elegant windows and statues) under the influence of the Vitruvian theories, whose progressive diffusion and interpretation occupy in Veneto a period comprising three generations of artists, from Fra Giocondo to Falconetto, from Serlio to Barbaro, and from Palladio to

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Scamozzi. The answer to this question may depend on a more accurate description of the monument, dimensions (about 18 m long and 5 m wide) seem to approximate to the Vitruvian model; where the porch with five arches and the overlying facade, punctuated by the row of the horizontal frieze with clipei and bucrania and the vertical lesenes surmounted by Doric and Ionic capitals, is configured as the recovery, still high in time, of the scene of the classic theatre, erected in the two regulatory orders (Vitruvius, De Architectura, V, 9), and harmoniously compared, in its frontal and volumetric aspect, to the reduced proportion of the site.[1]

The passage was quoted in full because it contains an explicit invitation to make an accurate survey of the monument. Moreover, in 1989 a Scientific Commission was set up to guide the restoration of the Cornaro house that took about ten years. Members of the Commission were professors Giovanni Calendoli, Manfredo Tafuri, Arnaldo Bruschi, Wolfgang Wolters, Giovanni Carbonara, Laura Tabasso, Guido Biscontin and ministry officials. The Scientific Commission has also repeatedly been called on to make a careful survey of the monument to carry out a critical architectural restoration, respecting all existing historical, artistic and functional properties (Carbonara and Berti 1997) (Fig. 12.1).

The study presented here is a partial response to these authoritative invitations. However, it also responds to a question maintained during the drafting of the various projects from 1989 to 2000: the restoration programme must proceed from the idea that the monument was conceived as architecture for a theatre or as a house for a humanist?

2 Did Falconetto Know the Roman Theatre?

In modern times, the path leading to the creation of an exclusive architecture for theatre is long and complex. It was identified by historians at the end of the fifteenth and early sixteenth centuries in Mantua, Ferrara, Urbino, Florence, Rome. At the end of the fifteenth century, theatrical performances were still occasional and did not have deputy buildings. Otherwise, new monumental architectures inspired by classical models were built for houses.

The composition of theatrical text is already a mature literary form when the place of representation has not yet defined an architectural character. We read in Calendoli (1985, 42):

> The comedians write for an ideal theatre. The comedies are performed in festivals, courtyards, squares, banqueting halls, with rich decorations or with few scenic elements, according to the possibilities. There is a considerable distance between the writing of the theatrical text and its representation. The theatrical text is governed by the precepts of classical literature, conversely, the representation of the text ignores the precepts of classical architecture.[2]

What could be the knowledge of the Roman theatre in Padua in the early sixteenth century? An archaeological notion of the scene began to spread among the humanists in the second half of the fifteenth century, between Rome and Venice. In a collection of theatrical architecture studies in the *Bollettino del Centro Internazionale di Studi di Architettura Andrea Palladio* (XVI, 1974 and XVII, 1975), the art historian Wolfgang Lotz wrote briefly (Lotz 1974) that the ideal reconstructions of the ancient theatre by the Renaissance architects were based on the finding of the ruins. The *frons scaenae* was difficult to recognize, so hypothetically the architects referred at the text of Vitruvius.

Lotz also hypothesized that Leon Battista Alberti's *De Re Aedificatoria* could have been a source of archaeological orientations. This treatise was printed for the first time in 1485 in Florence, but it was printed in Venice just in 1546. Classical theatre could most probably be known in Padua in the second decade of the sixteenth century, through the *Vitruvius* of Giovanni Giocondo, printed in Venice in 1511 (*M. Vitruvius per Jocundum solito castigatior factus cum figuris et tabula ut iam legi et intelligi possit*), where, in the *liber quintus,* are imprinted the tables of a classical theatre, rebuilt with great complexity of arguments.

[1] *Quando alla loggia sia stato aggiunto il piano superiore è difficile dire; e soprattutto è arduo stabilire se il monumento sia stato progettato fin dall'inizio nel suo aspetto attuale ed eseguito, per così dire, in due momenti successivi, oppure se esso sia stato completato con la sopraelevazione (comprendente l'elegante frequenza delle finestre e delle statue) sull'influsso delle teorie vitruviane, la cui progressiva diffusione e interpretazione occupa nel Veneto un arco di tempo comprendente tre generazioni di artisti, da Fra Giocondo a Falconetto, dal Serlio al Barbaro, e dal Palladio allo Scamozzi. La soluzione del quesito può dipendere da un più accurato rilievo del monumento, le cui misure in pianta (circa 18 metri di lunghezza per 5 metri di profondità) sembrano già approssimarsi a un ricalco del modello vitruviano; onde l'insieme del portico a cinque archi e della soprastante facciata, scandito dal tracciato del fregio orizzontale a clipei e a bucrani e dalle lesene verticali sormontate dai capitelli dorici e ionici si configura come il recupero, ancora alto nel tempo, della scena fronte del teatro classico, eretta nei due ordini regolamentari (Vitruvio, De Architectura, V, 9.), e armoniosamente rapportata, nel suo aspetto frontale e volumetrico, alle ridotte proporzione dell'ambiente*. [Transl. by Maurizio Berti] (Zorzi et al. 1982, pp. 9–10).

[2] *I commediografi scrivono per un teatro ideale. Le commedie sono recitate nelle sale delle feste, nei cortili, nelle piazze, nelle sale dei banchetti, con ricchi addobbi o con pochi elementi scenici, secondo le possibilità. Corre una notevole distanza tra la scrittura del testo teatrale e la sua rappresentazione. Il testo teatrale è governato dai precetti della letteratura classica, viceversa la rappresentazione del testo ignora i precetti dell'architettura classica.* [Transl. by Maurizio Berti] (Calendoli 1985, 42).

Fig. 12.1 Courtyard of the Alvise Cornaro House, today. *Source* Maurizio Berti

Giorgio Vasari connects Falconetto to Giocondo on the matter of ancient monuments, saying that this cognition was greatly aided by Giocondo (Vasari 1568, III, 270), while expressly declaring that Cornaro was a great friend of Giocondo (Vasari 1568, III, p. 247). He writes that Falconetto's archaeological studies continued throughout twelve years of life in Rome, where he returned with Cornaro. *And he was the first to draw theatres and amphitheatres and find their ground-plans; and those visible, and most of all that of Verona, came from him and were printed by others on his drawings* (Vasari 1568, III, 269).[3]

We have the drawings of the Marcello theatre in Rome to testify that Falconetto had understood the architecture of a classical theatre. We have also the Roman theatre in Verona and the architectures of Pola where, in addition to the amphitheatre, there were two Roman theatres. Unfortunately, these drawings cannot be used to support the topics discussed here. The *corpus* of antiquity drawings attributed to Andrea Palladio, and other architects of the first half of the sixteenth century, including Falconetto, was the subject of a long and in-depth critical examination by historians. In this critical path, the writings of Zorzi et al. (1958), Lotz (1962), Schweikhart (1980a, b) and Burns (1973, 1980) still direct the most recent studies. For the considerations gathered in this text, it is useful to refer to the assumption of Burns. He believes that some drawings of the *corpus* have been inspired by Falconetto, while he doubts that these drawings were drawn by Falconetto's hand (as it had been believed by Zorzi). Burns also accredits the testimony of Vasari describing Falconetto as an early Renaissance draftsman of the antiquities of Verona, Rome and Pola (Burns 1980, p. 84).

The interest in antiquity in Padua was introduced neither by Cornaro nor by Falconetto, but by humanists and antiquarians, who were present in Venice area already during the second half of the fifteenth century. Consider that such humanists and antiquarians were present in the Cornaro circle, since they had determined a philological attitude for antiquities between the second and third decades of the sixteenth century. In the field of classical architecture, Falconetto offered models that he had composed by measuring directly the proportions of Roman ruins and finding confirmation from the reading of the Vitruvius treatise or, at least, by discussing some of the arguments contained in this treatise.

[3] *E fu questi il primo che disegnasse teatri et anfiteatri e trovasse le piante loro; e quelli che si veggono, e massimamente quel di Verona, vennero da lui e furono fatti stampare da altri sopra i suoi disegni.* [Transl. by Maurizio Berti] (Vasari 1568, III. p. 269).

3 Looking for a General Idea

The argument of a general plan for the arrangement of the Alvise Cornaro palace was defined for the first time by the medievalist Paolo Sambin. The historian, by reading the testaments of the Cornaro family, allows us to identify a collation of houses and gardens near to St. Anthony's Basilica that Cornaro inherited (Sambin, 1966, 303–321).

This whole unit was not fully perceived by some historians, when they turned attention to the architectural style of the facade along the street, or to the beauty of remains inside the palace. The progressive decay of the property, however, has lost the perception of the unitary urban set. Giannantonio Moschini in 1817 gave notice of the demolition of the loggia in front of the Odeo and part of the palace on the public street, as documented by a drawing by the public topographer Lorenzo Mazzi in 1735.

In the publication of Mazzi's drawing, the art historian Giuseppe Fiocco, through some stylistic considerations, introduced the topic of a general plan for a single large palace, reforming the set of medieval houses that Alvise Cornaro inherited from his uncle Alvise Angelieri. But the suspicions of the demolition of the palace on the street led his studies on the Loggia and the Odeo, continuing with an ancient appreciation and neglecting the verification of a general building of the palace (Fiocco and Cornaro 1965, pp. 34–40).

Vasari writes about the Loggia and the Cornaro house in Padua (Vasari 1568, III. p. 269):

> He (Giovanmaria Falconetto) at that time did many things with messer Luigi; who desire to see the antiquities of Rome closely, as he had seen in the drawings of Giovanmaria, he went to Rome with him; where, having him always in his company, he wanted to see everything minutely. After back to Padua, he began to do the beautiful and ornate loggia which is in the Cornaro house close to Santo, according to the design and model of Falconetto, then he began the palace according to the model made by Messer Luigi himself.[4]

With this same quotation from Vasari, Sambin begins the meticulous review by noting and comparing contracts and notarial acts related to Alvise Cornaro's neighbours and tenants (Sambin 1966). It is a difficult reconstruction because property records of the past do not have that numerical order which facilitates the general reorganization of a map today. The interest of the scholar is limited to the urban area which includes the various parcels of Cornaro. The result is a quadrilateral figure which is the limit assumed in this study.

Between 1518 and 1526, Cornaro performs a series of actions to obtain the availability of all the buildings along the street and the respective open areas inside, without any intermediate interruption. Even in the shape, the condition reached by the properties in 1526 corresponds perfectly to the idea of a general area reordering.

These changes in the leased areas probably correspond to the succession of the different construction sites for the new palace, both for the building on the street and for the inner gardens. The adjustment of the facade opposite the Loggia in the new courtyard can only take place when Cornaro gets the full availability of the building overlooking the public street. The construction of the arcades on the right side of the court and the construction of the Odeo can only begin in 1526 because until then the property was rented.

Examining the sequence of documents collected by Sambin, we find the difficult acquisition of a last portion of the property. It seems to us that this difficulty may have delayed the realization of the general plan to the point of compromising the perfect execution of the Renaissance courtyard.

4 The Site for the Project

The observation of the wall in front of Odeo clarifies the incompleteness of the left side of the palace Cornaro courtyard and confirms the study of Sambin. The information, recognizable in the remains of this wall, corresponding to the historical documents, belonging to a period between 1511 and 1784, the date from which Cornaro inherited the property to the date of the *Veduta della loggia e rotonda in the Pianta di Padova* by Giovanni Valle (Fig. 12.2).

Observing this same wall in vertical projection, but at the level of the underground, we can be that it is the rectilinear extension of the wall separating part of the palace towards the street (here marked with numbers 5, 6, 7, Fig. 12.3). Such a wall is a boundary line that persists in historical and current maps. It has for extreme points a pillar of the portico to the south and, beyond the Loggia, the border of other properties to the north. The wall has an older historical value in relation to the time considered here. It is part of the so-called lotto medievale: a typological subdivision of medieval property parcels that still today model the urban buildings of the historic centre of Padua. The boundary wall is aligned to the first of the five underground walls of the building along the street that we see drawn in two historical surveys of 1727 and 1735.[5]

[4] *Il quale* (Giovanmaria Falconetto) *in detto tempo operò molte cose con detto messer Luigi; il quale desideroso di vedere l'anticaglie di Roma in fato, come l'aveva vedute nei disegni di Giovanmaria, menandolo seco, se n'andò a Roma; dove, avendo costui sempre in sua compagnia, volle vedere minutamente ogni cosa. Dopo, tornati a Padoa, si mise mano a fare col disegno e modello di Falconetto la bellissima e ornatissima loggia che è in casa Cornara, vicino al Santo, per far poi il palazzo secondo il modello fatto da messer Luigi stesso.* [Transl. by Maurizio Berti] (Vasari 1568, III. P. 269).

[5] Drawing of Giovanni Nardi. 1727, in: Archivio di Stato di Padova, Santa Maria della Misericordia, B. 67/7; Drawing of Lorenzo Mazzi. 1735, in: Archivio di Stato di Padova, Corporazioni soppresse, Monastero S. Antonio, T. 320 (Berti 1993, p. 176).

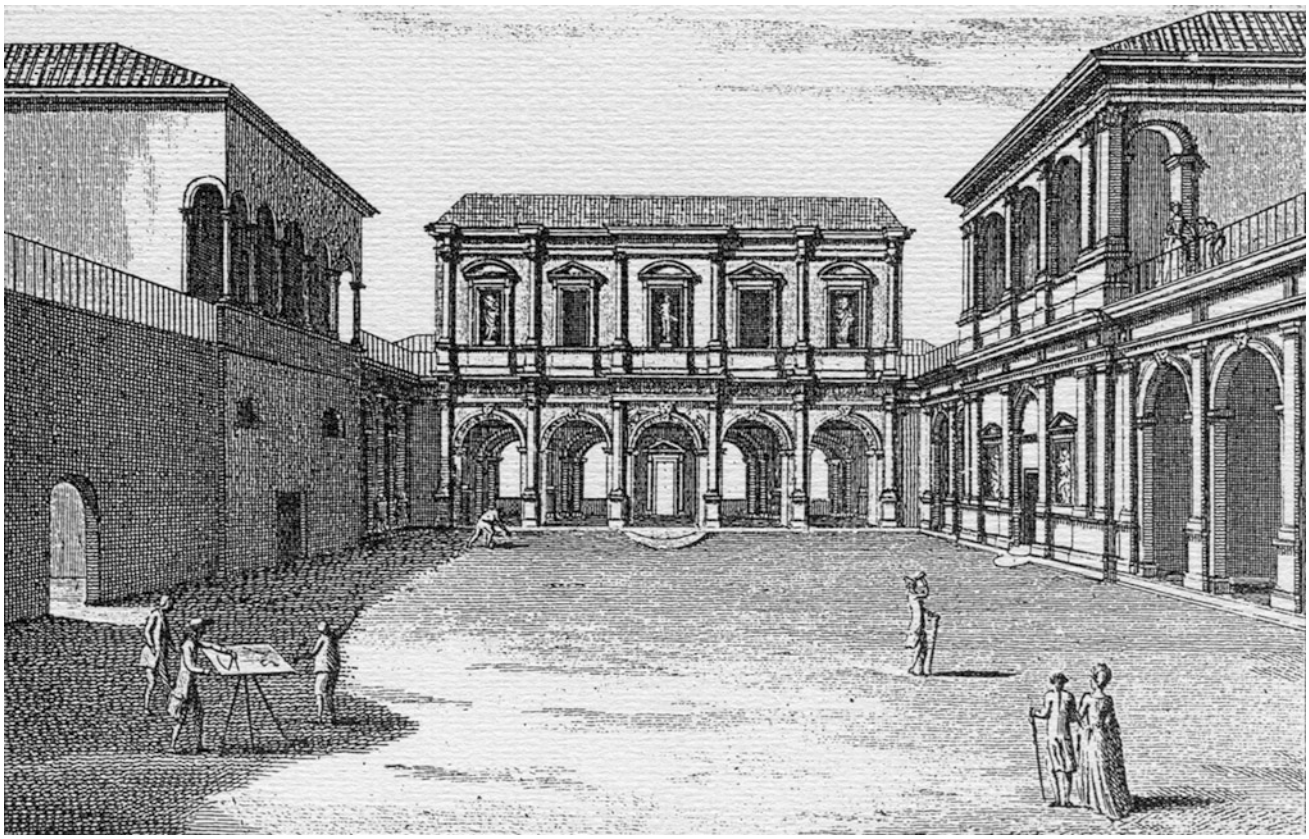

Fig. 12.2 *Veduta della loggia e rotonda* in the *Pianta di Padova* of Giovanni Valle, 1784 (part.). On the right: the loggia demolished before 1817; in the centre: the Loggia; on the left: the Odeo. *Source* From the copy owned by Maurizio Berti

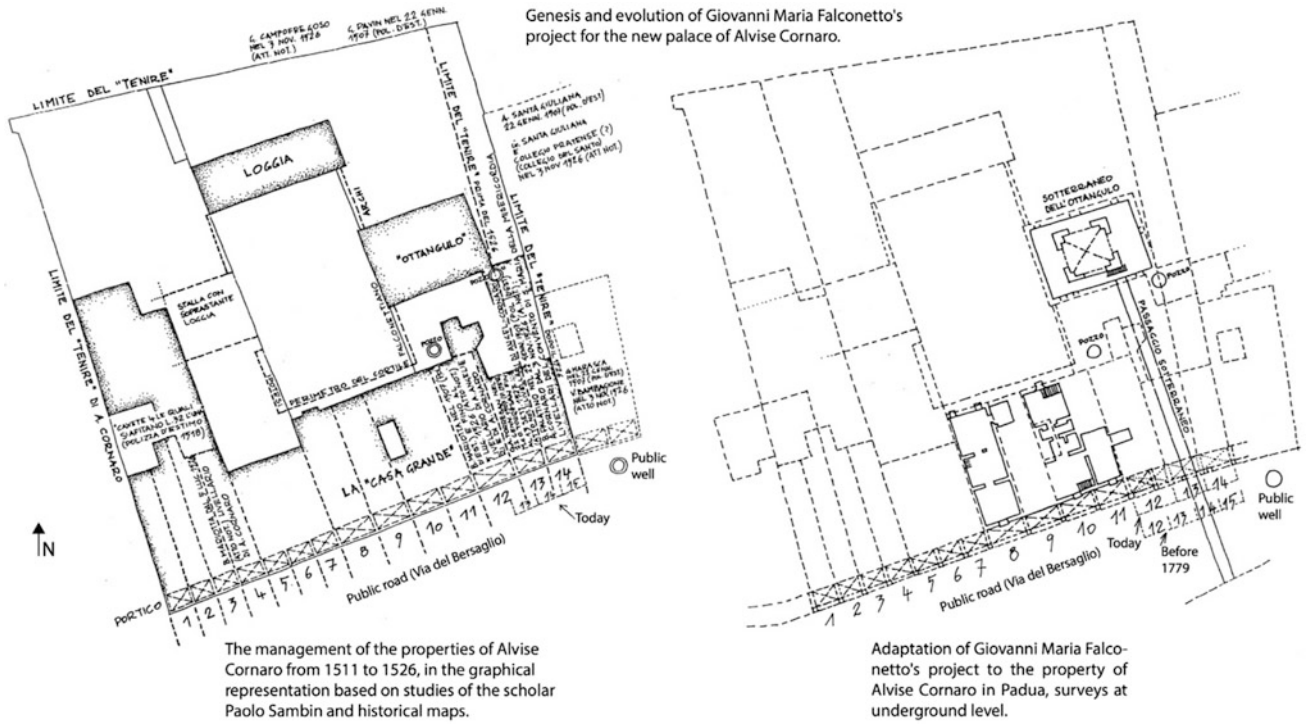

Fig. 12.3 Management of the properties of Alvise Cornaro from 1511 to 1526. *Source* Maurizio Berti

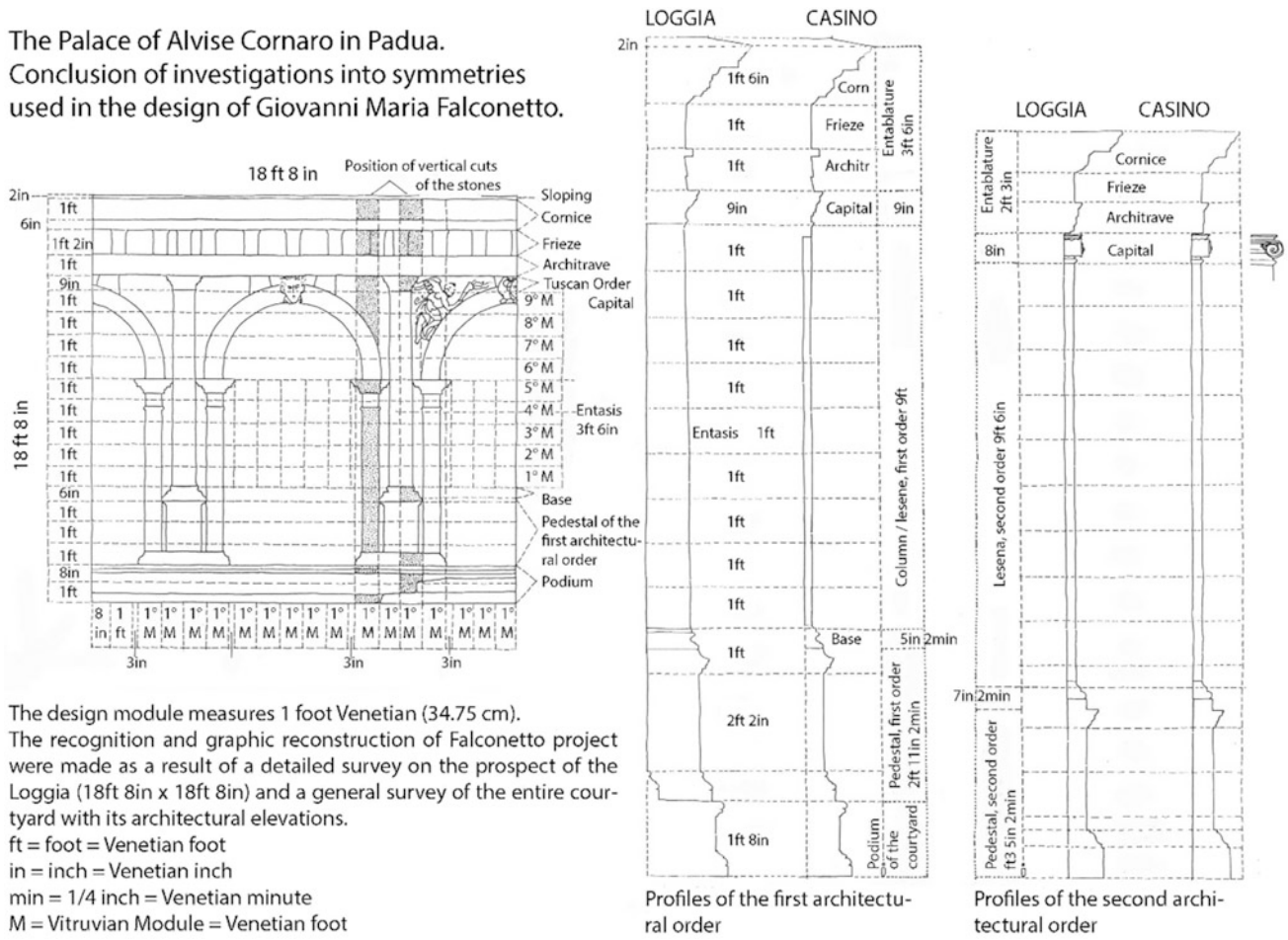

Fig. 12.4 Investigations into symmetries used in the design of Giovanni Maria Falconetto. *Source* Maurizio Berti

The walls dividing the five underground spaces must be permanent for static reasons and their typology is of course pre-Renaissance.

Omitting stylistic considerations, the alignment of buildings to the borderline of the *lotto medievale* suggests a previous position to the Renaissance structure of the courtyard. The conservation of this old side of the courtyard may have been an acceptable compromise for Cornaro, even if it only accords approximately with the rigorous symmetries designed by Falconetto.

Certainly, we cannot conclude that the loggia in front of the Odeo, which was demolished after 1784, was built before the Renaissance project. Sambin hypothesizes that this loggia was built after the Renaissance project, as an extension of a pre-existing building (Sambin 1966, 321–324), in a period between the second and third testaments of Alvise Cornaro: from 27 January 1555 to 27 April 1566 (Figs. 12.2 and 12.4).

5 The Sixteenth-Century General Project

Looking for the model of the palace made, according to Vasari, by Cornaro himself, we wanted to highlight the role of Falconetto. The architect not only designed the beautiful Loggia but was the creator of the overall architectural composition of the palace. In this composition, he adopted the proportional rules of Vitruvius, using a modular matrix. The module, as we know, is a basic unit of measurement that allows the abstraction of the project and originates in classical architecture. The abstraction of the project based on the module has a universal value. In the *I Quattro Libri*, Palladio reaffirms the need of its use because every Italian city in the Renaissance had its own units of measure (Palladio 1570).

In order to understand the mensural unit of Falconetto's symmetrical system, various tests have been carried out in the courtyard, using some probable units: the Roman

Capitoline foot, the Roman Architectural foot, the Verona foot, the Padua foot and the Venetian foot (Berti 1993).

The Venetian foot is a unit of measure which has proved to be commensurable with foot multiples in general measurements and submultiples in architectural detail measurements. Having established that the Venetian foot was the unit of the mensural system used to build the courtyard, the survey was completed with that system.

Based on the first collected data, a comparison was made with the measures of the court in the copper engravings of Gio. Antonio Battisti, 1786 (Alvarez 1980a, b). The mensural scale attached to these engravings shows that the author has drawn some symmetry relationships that are not present in the courtyard. An example: Battisti measures the depth of the Loggia in 14 Venetian feet. This is not true. Otherwise, the true depth is in 20 ft. Battisti wanted to attribute to the depth of the Loggia a proportion that corresponds to the fourth part of the extension of the prospect that he measures 56 ft., as is clear for us as well.

The symmetrical progression of the courtyard, taken from the two remaining sides, is, therefore, given by two main ratios: the measure ratio *dupla* and the *sesquialtera* measure ratio. These are the formulations given in the ninth book of Leon Battista Alberti's *De Re Aedificatoria* (1565). It is not easy to understand what the canonical measures of a courtyard of the *domus* should be, referring to the sixth book of the treatise of Vitruvius. The verification was carried out both on the edition of Giocondo (1511) and on Cesariano's commentary (1521).

The measures of the court are corresponding to the second of the three types of *atrium* for private houses: *Alterum cum in tres partes dividat, duae partes latitudes tribuantur* (Giocondo 1511, p. 62). In fact, 84: 3 = 28; 28 × 2 = 56 (the length of the courtyard is 84 feet; the width measurement is 56 feet). Vitruvius refers specifically to the dimensions of the *atrium*, but the courtyard of Padua would be a *cavaedium*, and in both Giocondo and Cesariano, the two places have distinct and different connotations. On the other hand, the Cornaro

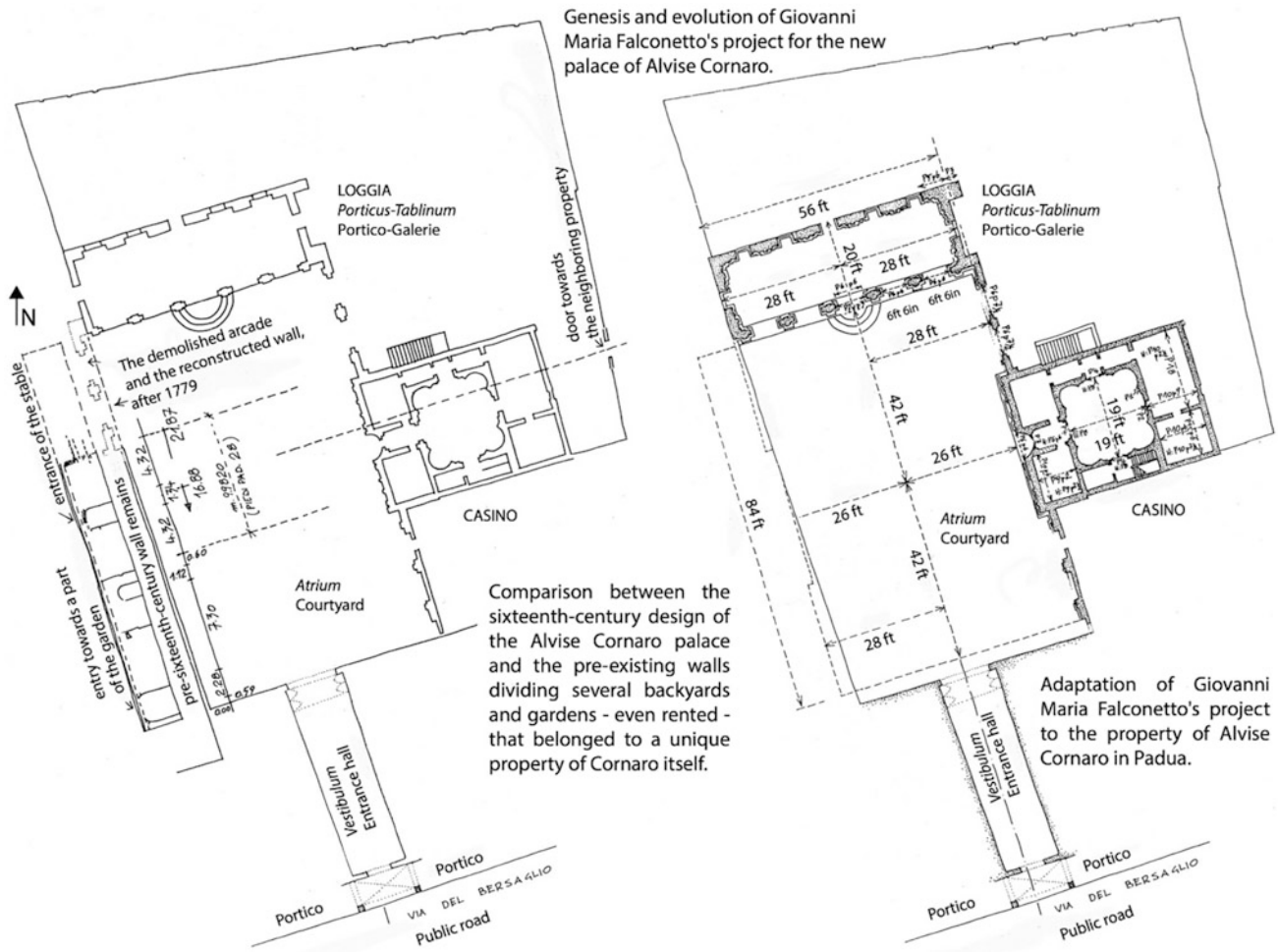

Fig. 12.5 Genesis and evolution of Giovanni Maria Falconetto's project. *Source* Maurizio Berti

palace may not be configured with any of the three types of *atrium* described in Vitruvius. Let us then go to Alberti, who in Chapter XVII of Book V of his treatise writes that the main part of all in the house is the *Cavedio* (cavaedium*)* or the *Atrio* (atrium) the one that you want, that we'll call it the *Cortile* (courtyard) with loggias (Alberti 1565, pp. 152–153).[6] *Cavedio* and *Atrio* are the same as the *Cortile* (Fig. 12.5).

The height of the court's facade of 18 ft. and 8 in. determines half of the court's width in a *sesquialtera* measurement (multiplying by 3/2), according to Alberti's method. Half courtyard width measures 28 ft. Applying a *dupla* measurement (multiplying by 2), 56 ft. is twice the size of 28 ft: the width of the courtyard. This measure accords with the demolition of part of the fifteenth (or even older) wall facing the Odeo, mentioned above. Adding 56 ft., a *sesquialtera* ratio, we get the length of the court: 84 Venetian feet.

This quadrilateral of 56 Venetian feet of width and 84 ft. in length does not reach, however, the inner facade of the building on the street. We have still 139 cm. This measure corresponds to 4 Venetian feet that is the width of the elevated walkway, above the cornice of the arcade, that serves to walk all around the court and putting in communication the palace on the street with the Odeo and the upper room at the Loggia.

6 Conclusions

The measurements of the courtyard, the Odeo, and the Loggia carried out using the Venetian foot (m 0.3475) reveal the drawing of the project by Giovanni Maria Falconetto. The revealed project responds to the rules of Vitruvius, not referring to the classical theatre but to the symmetries of one of the three types of private *domus* courtyard.

Ludovico Zorzi had done some tests overlapping the Vitruvian theatre scheme upon the courtyard plan. Without finding convincing correspondence, he suggested a detailed survey. We tried to give an answer to this invitation but using the measurement system used during the construction of the new Renaissance house of Cornaro. The measures taken with the Venetian foot revealed a play of architectural symmetries and, consequently, the general project of Giovanni Maria Falconetto. A project would probably not have been recognized if the measurements of the monument had been made with the decimal metric system.

In conclusion, we have shown that the renovation of the Cornaro house corresponds to the model of the Roman *domus* and not to a part of the classical theatre. The value of the aesthetic experience of Alvise Cornaro and Giovanni Maria Falconetto becomes, therefore, more relevant. However, the literary work of the great Ruzante, who was a good friend of Cornaro and Falconetto, is not diminished.

[6] *la principal parte di tutte è quella, la quale, o Cavedio, o Atrio che tu ti dica, noi lo chiameremo il Cortile con le logge.* [Transl. by Maurizio Berti] (Alberti 1565, pp. 152–153).

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Investigation of Daylighting Performance in UAE Heritage Museums

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Abstract

Over the last few years, the UAE government has been dedicated to transforming many of its treasured heritage buildings into museums. One issue with this, however, is that these buildings were not designed for this purpose. Therefore, ensuring they operate well in their new roles is a crucial question that has been thoroughly researched by the authors. This chapter aims to study the daylighting performance inside two selected heritage building cases. The daylighting system employed by these buildings is one that is engrained in the traditional architectural practice of Dubai (latitude 25°N longitude 55°E). It captures daylight by its traditional window (termed locally the Dreesheh) from a private courtyard (through a midway arcade) or from a public alley. Numerous site visits to four heritage museums were executed in order to categorize the main artifacts and assess the illuminance exposure based on each category type. Moreover, for the simulation process, measurements of the different lighting levels were taken on site, in order to calculate the reflectance values of the interior and exterior surfaces. Two exhibition spaces with different sizes were selected to conduct the required detailed analysis. Computer simulation was used to evaluate the luminous environment in the spaces with special consideration to artifacts' exposure to the light and potential problems of deterioration. The results were analyzed, and design improvements with regard to spatial arrangement, openings, and implementation of shading were suggested.

Keywords

Daylighting • Museums • UAE • Artifacts

1 Introduction

Due to the severe heat and difficult weather conditions of the UAE desert climate, heritage buildings were built to withstand such settings, respect the traditions, and to use the available construction materials in such a way that respect the social, environmental, and cultural values of the region (Abdulac 1982; Khattab 2001). The traditional mode of construction was perfected by experience acquired throughout the years; however, as a result of the oil discovery in the region by the late 1950s, traditional ways of building were replaced by more advanced construction technology and materials. Consequently, vast areas of traditional buildings were replaced by newer ones reflecting a more modern architectural style. The UAE architectural heritage identity was disappearing from its landscape, making authorities realize it was time to maintain and preserve their past. As a result, new laws were put in place in order to ensure the conservation of their heritage buildings. Many of these buildings, which were previously serving as a residence for rulers or high-status families, were then converted into spaces that fulfill a variety of functions, including museums, governmental offices, bases for non-profit corporations, galleries, and locally themed restaurants.

When designing any building type, natural lighting is one of the most critical factors that should be taken into consideration. More importantly, in museums, it requires more attention to ensure visitor's satisfaction as well as artifacts, protection. Visual comfort could be negatively affected to a large degree as a result of poor indoor lighting. Factors such as high contrast, direct sunlight, and visual discomfort could play a significant role in creating an unpleasant environment for visitors. Furthermore, various studies have concluded that environmental parameters within the museum space must be controlled based on the protection and conservation of artifacts in order to avoid their deterioration or degradation of their vision (Cassar 2013; Pavlogeorgatos 2003). Environmental temperature, relative humidity, exhibits'

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temperature, atmospheric pollution, and improper lighting are all examples of environmental parameters that could destroy the displayed articles and their preservation. Additionally, the high UV radiation of light poses an added threat to the list, with its high chance of causing irreversible damage to the exhibits.

In previous studies (Bin-Dalmouk 2015; DeKay and Brown 2013) about daylighting in courtyard buildings, the volumetric aspect ratio of the courtyard was considered an effective parameter, since it expresses the full relationship between space volume and daylighting penetration to the indoors. The volumetric aspect ratio of the courtyard can be defined as follows:

$$\mathrm{VAR} = \frac{(W \times L)}{H^2} \quad (1)$$

where W is the courtyard width, L is the courtyard length, and H is the courtyard height.

Bin-Dalmouk (2015) investigated the relationship between the VAR and the daylight autonomy (DA). Increasing the VAR value results in increasing the daylight autonomy (DA). DA is defined as the percentage of a defined period (i.e., usually the building's occupied hours of one full year) during which interior illuminance exceeds a target illuminance level (IESNA 2011). For the ground floor spaces with 40% window-to-wall ratio (WWR) looking upon a rectangular courtyard with a width-to-length proportion of 1:2, the impact of VAR on DA is significant when VAR changes from 1 to 10; it results in a sharp increase in DA up to 18%. This effect increases when WWR increases and/or the spaces are located on the upper floor.

The authors have been investigating daylight performance in heritage museums. One of their earlier studies (Al-Sallal and Bin-Dalmouk 2011) relied on the daylight metrics *illuminance level* (lx), *light exposure* (lx h), *light distribution and uniformity, and luminance levels* to evaluate a relatively small exhibition room (2.73 m × 3.65 m) with VAR value of 1.19, located in the Sheikh Mohammed Center for Cultural Understanding of Dubai. It depended on field measurement and computer simulation, using Desktop Radiance 2.0 Beta (DR), to simulate daylighting at 9:00 a.m., 12:00 p.m., and 3:00 p.m. on the solar summer and winter solstices (June 21 and December) and spring and fall equinoxes (March 21/September 21). The investigations revealed a number of problems that could lead to serious risks of artifacts' deterioration in addition to potential glare/visual discomfort issues for the museum's visitors. After realizing these issues, the research in the recently published studies by the authors investigated other important variables (Al-Sallal and AbouElhamd 2018; Al-Sallal et al. 2018). It used a more comprehensive analysis process that considered the weather and sky changes across the year and the impact on daylighting in the building during its full occupancy hours (3650 h/year). It utilized the Diva-for-Rhino daylighting simulation program to simulate the climate-based daylight metric (CBDM), *daylight autonomy*. The used method helped quantify the daylight performance change as a function of changing the WWR. Both studies have revealed that shading the windows is highly needed to serve in reducing light exposure for the artifacts and improving visual comfort and daylighting quality. The current study uses two real museum cases. The first is the Sheikh Mohammed Center for Cultural Understanding of Dubai (SMCCU, mentioned above) and the second is the Heritage House Museum (HHM) in Al Ras District of Dubai. The focus is to investigate how two differently configured exhibit spaces (one from each of the mentioned museums) affect the daylight performance. Computer simulation using Diva-for-Rhino along with Microsoft Excel was utilized to calculate a number of CBDM metrics: daylight autonomy (DA), useful daylight illuminance (UDI), and cumulative light exposure (lx h/year).

2 Background

A museum has three basic responsibilities: (1) protect collections from potential damage; (2) gather and display art and historic articles that enrich a visitor's experience, both educationally and recreationally; and (3) perform the aforementioned tasks in a highly efficient manner (Miller and Miller 2005). To do this, a museum needs both good presentation and effective preservation. A major challenge is that the exhibition of artifacts increases the possibilities of damage due to environmental factors. The artifact's risk of damage increases when it becomes more visible and accessible. These risks include photochemical damage (yellowing, loss of strength, fading, fraying of fabrics, darkening of colors, considerable changes in color pigmentation) and photomechanical damage (surface cracking, loss of colors, lifting of surface layers, structural damage) (IESNA 1999).

Damage to artifacts caused by light can be minimized using several different methods: to employ an efficient lighting design that decreases total light levels, utilize a full visible lighting spectrum that completely represents all colors, ensure shadows, glare and reflections are eliminated, backgrounds are subtly lit, and artifacts properly lit. In addition to that, ensure the use of appropriate light sources that eliminate non-visible radiation (UV, IR), and adjust lighting to match existing colors. This lowers the amount of energy absorbed without affecting the reflected energy that the eyes see (IESNA 2011; CCAHA 2007).

As stated by the IES (previously, Illuminating Engineering Society of North America IESNA) and the Conservation Centre for Art and Historic Artifacts (IESNA 2011; CCAHA 2007), there are maximum illuminance limits

Table 1 Recommended illuminance (lx) and cumulative light exposure (lx h/year) limits, as adopted from IESNA (1999, 2011) and CCAHA (2007)

Type of material	IESNA		CCAHA[a]
	Maximum illuminance (lx)	Light exposure (lx h/year)	Light exposure (lx h/year)
High sensitivity to light Books, botanical, specimens, costumes, cotton, drawings, dyes, leather, feathers, fugitive dyes, fur, gouache, insects, manuscripts, miniatures, paintings in distemper media, paper, prints, silk, skins, some minerals, some photographs, stamps, tapestries, textiles, wallpapers, water colors, wool, and writing inks	50	50,000[b] 150,000[c]	50,000
Low sensitivity to light Bone, horn, ivory, lacquer, leather, oil paintings, some plastics, some photographs, tempura painting, textiles with stable dyes, and wood finishes	200	480,000[b] 600,000[c]	100,000
Less light sensitive Paper-based artifacts	–	–	300,000
No light sensitive Ceramics, enamel, glass, jewels, metal, most minerals, stone, and wood	1000	–	–

[a]Adopted from CCAHA (2007). CCAHA specializes in the treatment of art and historic artifacts on paper
[b]Adopted from IESNA (1999)
[c]Adopted from IESNA (2011)

for every display room, as well as recommended light exposure limits for exhibits (lx h/year). These values are specified in Table 1.

UAE museums contain highly sensitive, valuable, and rare historical documents that are 150 years old or more, for instance, contracts, letters exchanged between past leaders, and itineraries explaining the pearl diving industry. Customarily, they are restored and conserved by being housed in museums or restoration centers. According to Juma Majid Centre for Culture and Heritage in Dubai, locations that have excessive heat, humidity, and sunlight caused the worst type of damage to display items. Such centers and museums assume the responsibility of ensuring these rare artifacts are protected from such destroying factors by eliminating or at least minimizing them.

The concept of transforming old houses into museums has become a popular and common practice in the UAE, due to the tourism economy and the mission to conserve cultural values. Nevertheless, because these buildings were not originally designed as museums, a question on how they could function as a safe daylit environment for their holdings could be raised. Thus, this research aims to study and understand the daylighting performance in two differently sized/configured museum spaces capturing daylight by the traditional double panel window (the Dreesheh), the first from a private courtyard (through a midway arcade) and the second from a public alley. The investigation focuses on the following factors: adequacy of illuminance levels and impact of light exposure on museum articles as well as detection of possible glare or visual discomfort. Two cases of exhibit spaces each having the Dreesheh window typology are evaluated, and recommendations to improve their lighting environment were proposed. Architects, designers, and museum curators will benefit from this research because the findings can help comprehend how daylighting systems perform in the indigenous buildings and how their designs can be improved to accommodate museum requirements.

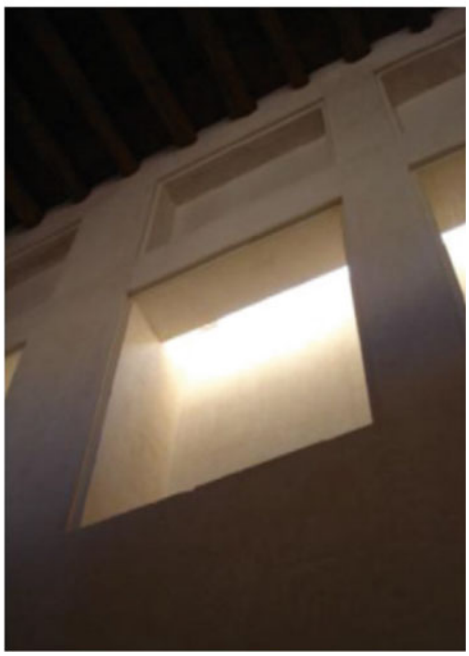
The significance of daylighting in museums has many aspects. It enriches the visitor's experience psychologically and raises their appreciation of artwork and architecture (Engineer 2015; Hefferan 2008; Li et al. 2005; Mueller 2013; IESNA 1999). Additionally, daylighting is seen as an important technique to help obtain energy savings. Relying on daylight for interior lighting can reduce electric lighting consumption by 30%, as stated by the IESNA Lighting Handbook. This decreases CO_2 emissions and, as a result, the greenhouse effect as well. Utilizing these daylight benefits to full capacity helps keep and maintain a visually comfortable environment.

The design of openings in the UAE's heritage buildings fulfilled two main functions: ventilation and daylight. In order to maintain privacy and security, and control daylight levels, windows were covered by three different components: gypsum ornaments, iron bars, and wooden shutters. Subsequent to the rise of maritime trading in neighboring countries, glass was introduced to the heritage windows. The windows in the current heritage museums are usually constructed with double panel glass. The heritage building openings (Fig. 1) can be classified into four categories:

Dreesheh (double panel window)

Barjeel (wind tower)

Mesbah (lantern window)



Masgat (air puller)

Fig. 1 Four categories of the heritage building openings

a. Dreesheh (double panel window): Dreesheh translates to window in the local dialect. This research studies the performance of this window type due to its importance and dominance in heritage buildings. It is used for lighting and views (Fig. 2). Usually covered by iron rails for security, this window measures about 110 × 70 cm. Wooden shutters found on the interior act as control tools for fully/partially opening/closing the window. This window is usually the largest of heritage window types and can be found on both the exterior of the house and the interior, looking into the courtyard.
b. Mesbah (lantern window): This window is used in everyday rooms and bedrooms. Shielded by either iron bar or gypsum ornaments, it is found on the upper

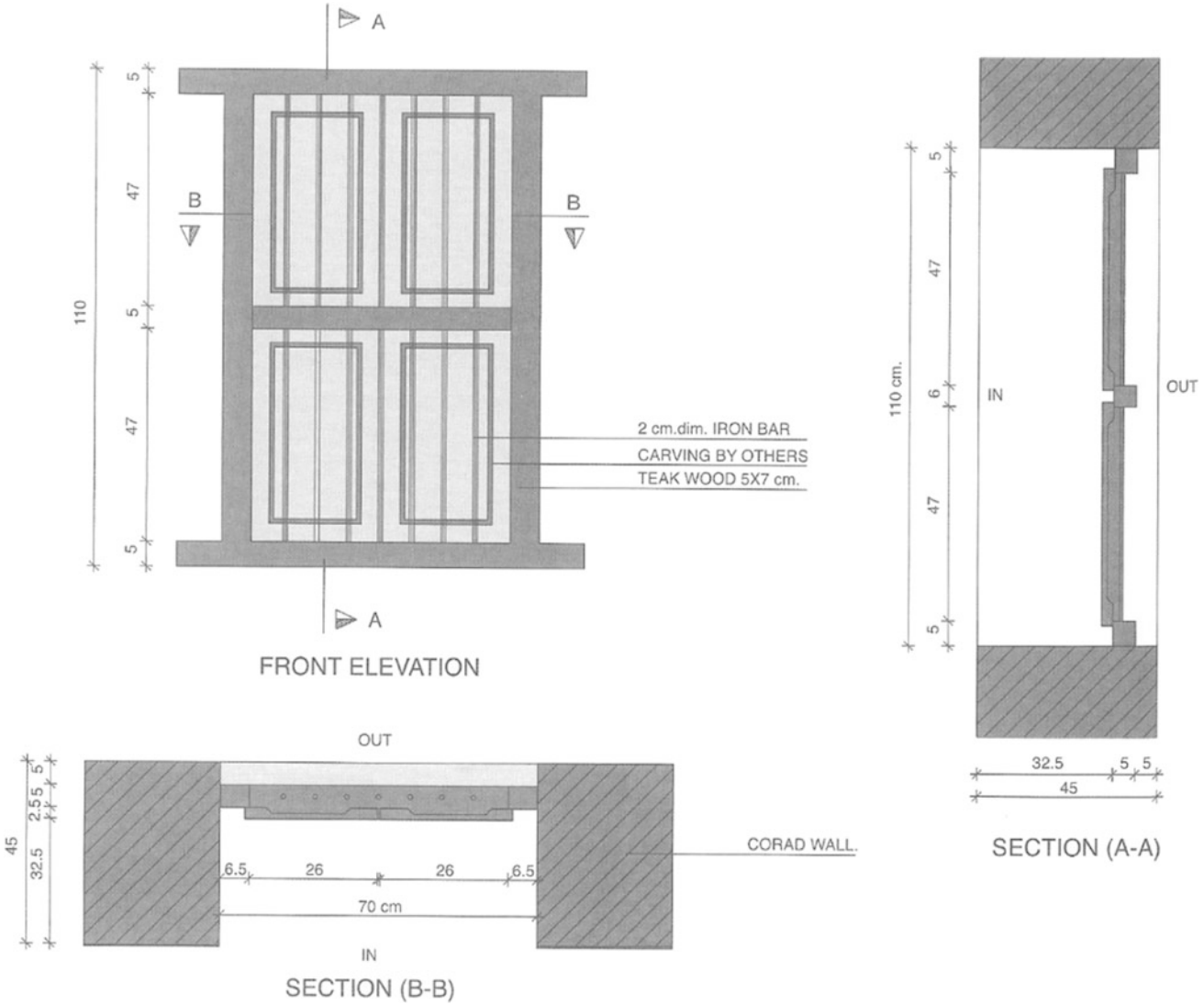


Fig. 2 Architectural drawings and dimensions of the traditional Dreesheh window in Dubai (Dubai Municipality 2000)

portion of the wall. The size differs based on room areas and location, and it is usually smaller than the Dreesheh window.

c. Barjeel (wind tower): The Barjeel is the most distinguishing architectural component of heritage buildings. Consisting of four open sides, each side is hollowed into a concave v-shape that deflects the wind downward to cool the rooms below. Water is sometimes thrown at the foot of the tower, inside the house, in order to add an evaporative cooling effect. The tower's vent can be opened and closed based on the need for cool air.
d. Masgat (air puller): This window type performs mainly as a ventilator while providing limited light, especially in circulation zones and family gathering areas. Located on the outside, it is recessed into the wall, casting shadows within the recessed space, and thus reducing the temperature nearby. This design creates a wind draft through the room, commencing from a small opening at the top.

3 Methodology

The study consisted of several steps: (1) in order to experience and understand the lighting environment, site visits to heritage museums were carried out, such as Dubai Museum, H. H. Sheikh Saeed House Museum in Dubai, Sheikh Mohammed Center for Cultural Understanding in Dubai, The Heritage House Museum in Dubai, and Al Ain Museum in Al Ain; (2) classification of the typical artifacts housed in the heritage museums into three types: (a) highly sensitive,

(b) low sensitive, and (c) no sensitive, in order to evaluate the total acceptable illuminance exposure limit with regard to each classification type based on IESNA and CCAHA recommendations; (3) selection and analysis of two exhibit spaces with the Dreesheh window prototype; (4) on-site measurements, which helped identify the reflectance values of the indoor/outdoor surfaces to be used in the simulation and produce actual reference data to validate the simulation program accuracy; and finally (5) a large range of simulation scenarios was carried out using computer simulation, in order to comprehend the luminous environment of the studied spaces in detail.

From the site visits to several heritage museums, the typically exhibited artifacts were classified into groups as follows (see Fig. 3):

1. Significantly valuable manuscripts and documents such as treaties, letters, maps, decrees, and agreements that were vital in shaping the country's history.
2. Old currency notes, stamps, and postal stationery.
3. Traditional clothing and textiles.
4. Female jewelry with a large selection of bead necklaces agate, bronze, and soft stone. Some of this jewelry is considered prehistoric.
5. Human skeletons and bones that were excavated from graves that date back to the third millennium B.C.
6. Some of the earliest coinage, silver ornaments, and costume accessories.
7. Traditional weapons such as rifles and guns, additionally bronze daggers and arrowheads that date back to the first, second, or third millennium B.C.
8. Ceramic and basalt pottery, of which some are considered prehistoric, consisting mostly of vessels and plates.

The first two groups in the above list correspond to the high sensitivity category, listed in Table 1. The last three groups correspond to the no sensitive category, listed in Table 1. The other groups (number 3–5) correspond to the low sensitivity category in Table 1.

Two differently configured exhibit spaces were selected for the daylighting analysis. The first one measures 2.73 m × 3.65 m. It has a Dreesheh window on the east

Fig. 3 Typical displays in the heritage UAE museums

sidewall with only one Dreesheh window (a total of window-to-wall ratio or WWR = 12%), looking upon the public alley. The window has no shading except for the operable window shutters. The second one measures 8 m 3 m. It has three Dreesheh windows on the southwest sidewall with WWR of 12%, looking upon the courtyard. This room is shaded with a deep arcade (3 m) in addition to operable window shutters. The first exhibit space case is located in the Sheikh Mohammed Center for Cultural Understanding (SMCCU), situated in Al Bastakiya District of Dubai. This building dates back to the early 1920s (Fig. 4). The building was constructed originally as a house with two floors, centered around a courtyard (VAR = 1.19). It has numerous rooms, including the social space, "Majlis." The second exhibit space is located in the Heritage House Museum (HHM) in Al Ras District of Dubai (Fig. 5). This heritage museum is a two-story building with a courtyard configuration (VAR = 3.52). It includes several exhibit spaces in the ground and first floors. The windows of the two cases have double pane clear glass with 88% visual transmittance, which was considered in the simulations of both cases. These two exhibit spaces are differently configured with regard to the following: (1) daylighting accessibility/solar shading (indirect daylight from a private courtyard via a deep transitional arcade versus direct daylight from a public alley) and (2) room proportion (rectangle versus semi-square plan), which was seen useful for the purpose of this study. Interior views of the selected rooms in the SMCCU and the HHM are shown in Fig. 6.

The on-site measurements were performed for two purposes: first, to validate the results produced by the simulation engine RADIANCE based on illuminance analysis; and second, to identify the reflectance values of the room surfaces (i.e., the walls, ceiling, and floor) based on luminance analysis in order to use them in the simulations. For the first purpose, the study depended on previous illuminance

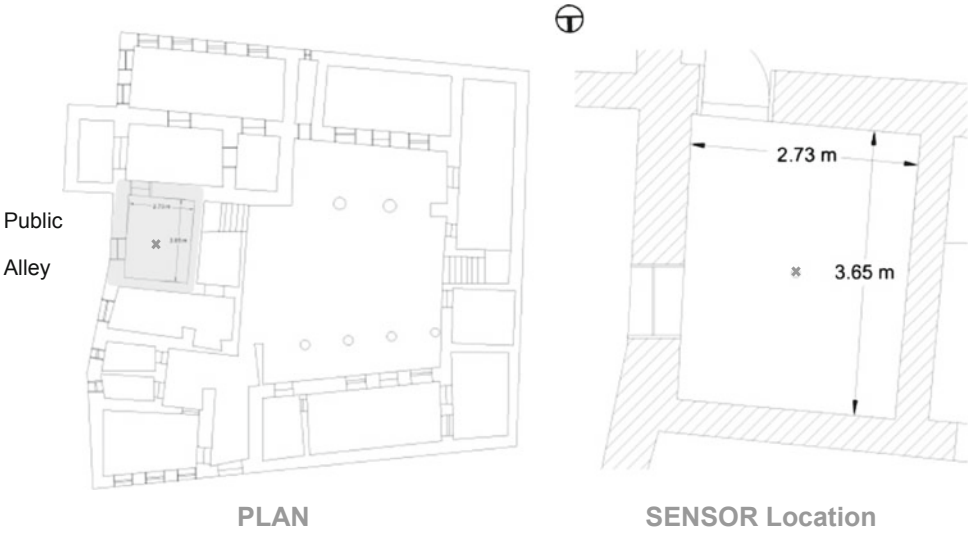


Fig. 4 Floor plans of the SMCCU case and the selected exhibition room

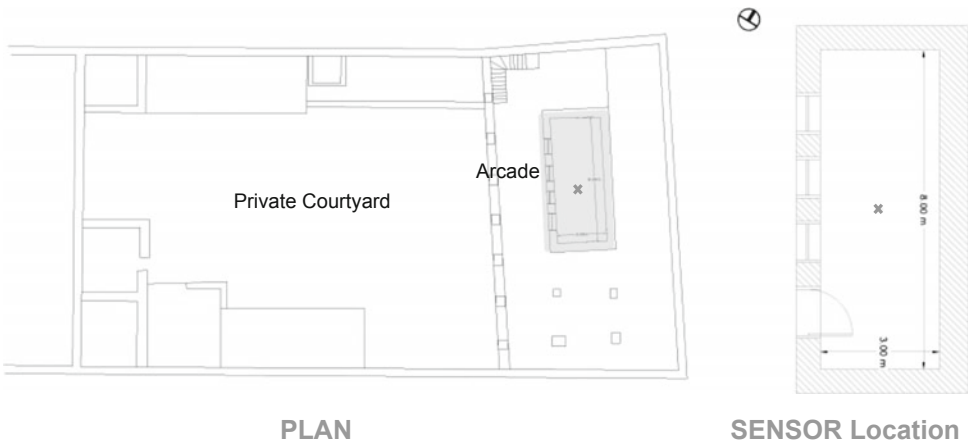


Fig. 5 Floor plans of the HHM case and the selected exhibition room

Fig. 6 Interior views of the selected rooms in the SMCCU (left) and the HHM (right)

Table 2 Reflectance values for the studied spaces

Material name	Location	Reflectance (%)
Heritage beige carpet	Floor	17.98
Heritage local off-white paint, sarooj	Wall	85.53
Dark brown chandal local wood	Ceiling, door, window frame	34.00

measurements conducted in 2011 of the small exhibit space of the SMCCU case (Al-Sallal and Bin-Dalmouk 2011). They were taken in the center of the exhibit space at height of 90 cm on June 10, July 10, and August 10 at 12:00 p.m., 2:00 p.m., and 4:00 p.m. using TES light meter (model number: 1336 data logging illuminance meter). Another illuminance meter was located outside to measure the horizontal exterior illuminance (HEI). The aim of measuring the illuminance inside and outside the exhibit space was to compare it with the results produced by the simulation tool to validate the calculations. For the second purpose, the study depended on two sets of luminance measurements; the first set was performed as part of the previous stage (explained above) for the small exhibit space of the SMCCU case (Al-Sallal and Bin-Dalmouk 2011), and the second set was performed recently for the large room of the HHM case. In both sets, the luminance levels of the interior and exterior surfaces were measured using Konica Minolta luminance meter (model LS-110) as well as the Kodak Gray Card. The measurements helped to obtain the reflectance values of the different surfaces. The reflectance of these surfaces, as measured on-site, is listed in Table 2. The reflectance values in the simulation runs were entered to match the measured on-site data (see Table 2).

The study utilized the Diva-for-Rhino program to perform detailed simulations. The Diva-for-Rhino program uses RADIANCE and DAYSIM as its basic daylight simulation engines (Solemma 2018). In-depth analyses of the lighting environment in the case studies were performed to investigate its effect on the displayed artifacts. The tested metrics included illuminance levels (lx), daylighting autonomy (DA), useful daylight Illuminance (UDI), and light exposure of artifacts measured in lx h per year.

4 Results and Discussion

4.1 On-Site Measurement

1. *On-site measurement*—The data obtained from the small exhibit space of the SMCCU case were used to validate results produced by the simulation engine RADIANCE. The results showed a high correlation between the on-site

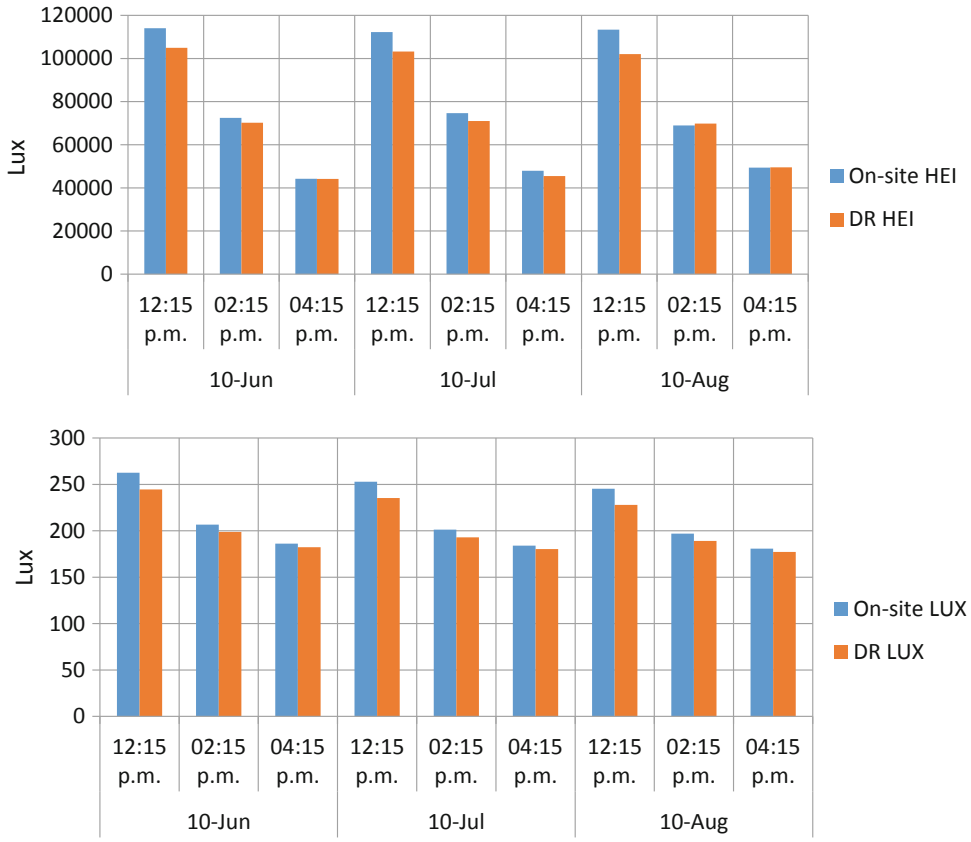


Fig. 7 On-site measurements (on-site LUX) versus the values generated by the simulation tool (DR LUX) for the horizontal exterior illuminance (HEI) and room center illuminance (Lux)

measurements and the values generated by the simulation tool, taken at the same points and times. The horizontal exterior illuminance (HEI) is measured as a reference to the interior horizontal illuminance measure, and the value, as generated from the sky file in the simulation tool, was calculated for comparison. The results are presented in Fig. 7. The difference between the actual on-site measurements and the simulated values from the sky files was around ±4%.

4.2 Daylighting Autonomy (DA)

The DA threshold was set based on the sensitivity of the display materials. The DA threshold was set to 50, 200, and 1000 lx based on the IESNA lighting handbook (10) recommendations for the high-sensitive, low-sensitive, and no sensitive materials, respectively. The calculations of the spatial DA throughout the room showed almost the same value (100%) for the high sensitive and low sensitive materials, while it is 23% for the no sensitive materials. This value represents the percentage of the space in which the illuminance levels exceeded the Lux threshold. Figures 8 and 9 show the results visually using a color scale (on the right) that represents the DA percentage for each module of the evaluation grid in the two exhibition rooms. The red color tones represent the highest values (nearest to 100%), while the blue color tones represent the lowest values (nearest to 0%). The $DA_{(50\ lx)}$ and $DA_{(200\ lx)}$ simulations (Fig. 8) revealed that the room of the SMCCU case is not safe for the high sensitive and low sensitive materials, respectively, because (almost) all of the room areas will experience illuminance levels that are greater than the entered Lux threshold, for 50% of the occupied hours. The $DA_{(1000\ lx)}$ simulation revealed that 23% of the room areas will experience illuminance levels $\geq$1000 lx, for 50% of the occupied hours (77% daylight safety). The $DA_{(50\ lx)}$ simulation (Fig. 9) revealed that the room of the HHM case is not safe for the high sensitive materials, because (almost) all of the room areas will experience illuminance levels $\geq$50 lx, for 50% of the occupied hours. The $DA_{(200\ lx)}$ simulation revealed that 52% of the room area will experience illuminance levels $\geq$200 lx, for 50% of the occupied hours (48% daylight safe). The $DA_{(1000\ lx)}$ simulation revealed that 0% of the room area will experience illuminance levels $\geq$1000 lx, for 50% of the occupied hours (77% is safe).

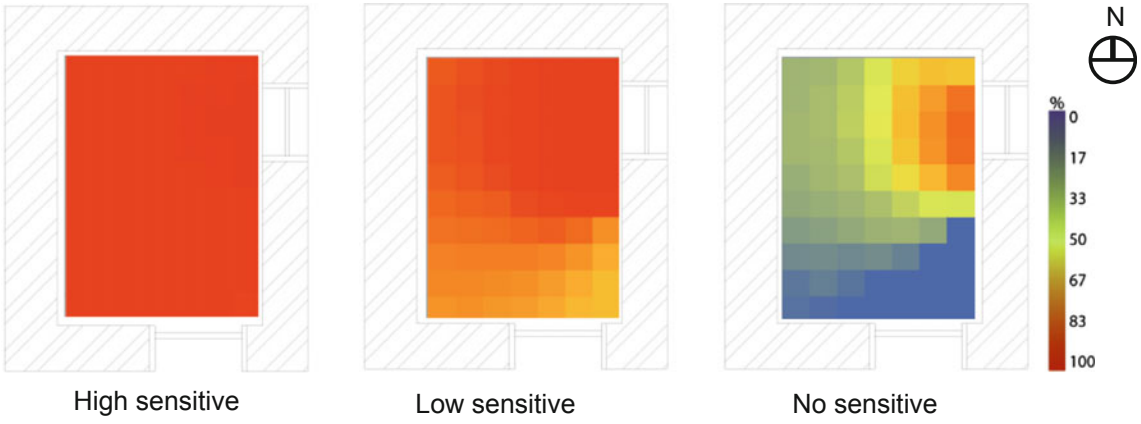


Fig. 8 Daylighting autonomy (DA) results for the exhibit space in the SMCCU case, shown for the high, low, and no sensitivity categories

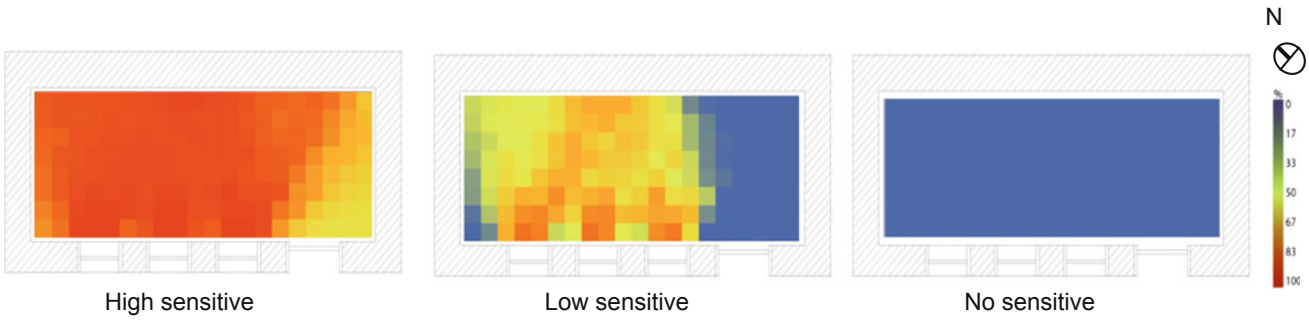


Fig. 9 Daylighting autonomy (DA) results for the exhibit space in the HMM case, shown for the high, low, and no sensitivity categories

4.3 Useful Daylight Illuminance (UDI)

The common method, when performing the useful daylight illuminance (UDI) calculations, considers the values that are less than 100 lx as "too little" light, the values that are between 100 and 2000 lx as "useful daylight," and the values that are more than 2000 lx as "too much" light (10). These divisions can be useful in designing buildings where higher levels of illuminance are recommended for tasks such as writing, reading, typing, which are typically performed in office or educational buildings. In museum buildings where conservation of the valuable artifacts is at the uppermost priority, the most useful daylight is when illuminance levels do not exceed 100 lx. For the SMCCU case, the results showed that the percentage of the room area that detected illuminance levels <100 lx is 0%, between 100 and 2000 lx is 94%, and >2000 lx is 4%, for at least 50% of the time. These results indicate that the SMCCU room is not safe, especially for the high sensitivity category of artifacts. The low value of the $UDI_{(>2000\ lx)}$ (4%) in this room indicates a reasonably high level of safety with regard to sunlight exposure. For the HHM case, the results showed that the percentage of the room area that detected illuminance levels <100 lx is 21%, between 100 and 2000 lx is 79%, and >2000 lx is 0%, for at least 50% of the time. These results indicate that the HHM room is safer than the SMCCU. The zero value of the $UDI_{(>2000\ lx)}$ indicates high level of safety with regard to sunlight exposure. Figures 10 and 11 show the UDI visual results for the exhibition spaces of the SMCCU and HHM cases, respectively. These visual results, along with the ones of the DA, can help museum curators to choose the safest locations for the high sensitivity category and the second safest for the low sensitivity category. The remainder of the space can be used for the no sensitive categories. If the entire room is not safe for the high sensitivity category, the artifacts of this category should be isolated in separate rooms with smaller WWR and more effective shading systems.

4.4 Artifacts' Exposure

Another important issue, with regard to ensuring the preservation of artifacts, is to check the total exposure in terms of lx h per year against the recommended values given by the lighting authorities' guidelines, as summarized in Table 1. For the exhibit spaces of the SMCCU and HHM cases, the calculated values in the center of the rooms for the high sensitivity

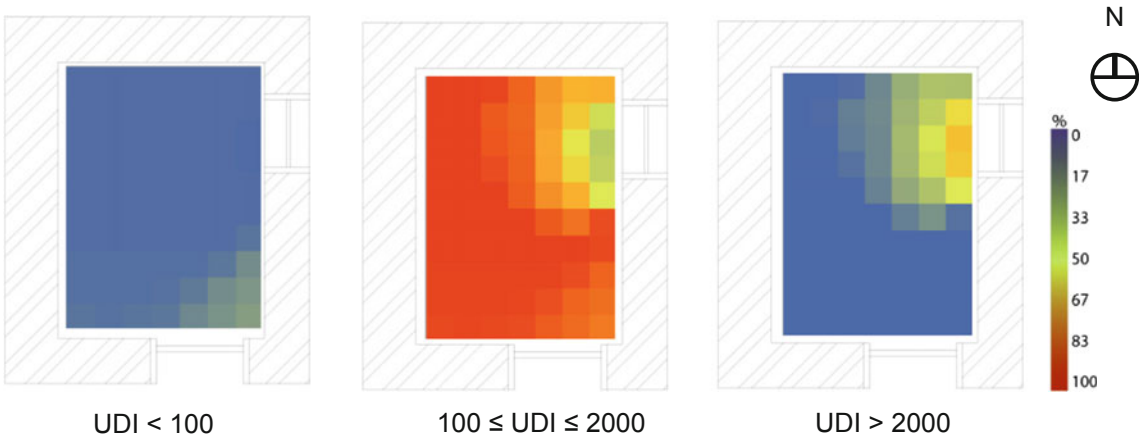


Fig. 10 Useful daylight illuminance (UDI) results for the exhibit space in the SMCCU case

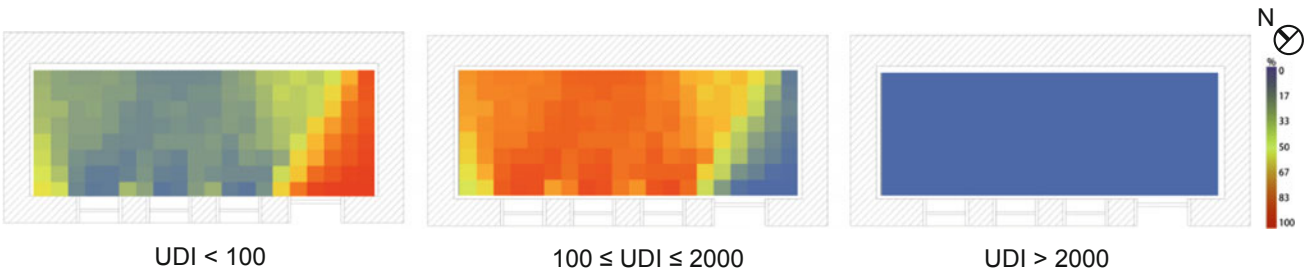


Fig. 11 Useful daylight illuminance (UDI) results for the exhibit space of the HHM case

category were 178,850 lx h/year and 169,725 lx h/year, respectively. These values are higher than the recommended values by the IESNA (150,000 lx h/year); thus, the center of these two rooms is unsafe for the high sensitivity category. This suggests that the zone near the windows would have higher values; thus, the need for shading and daylight distribution elements should be considered (e.g., light shelves or louvers). The calculated value in the center of the rooms in the SMCCU and HHM cases for the low sensitivity category was 624,150 lx h/year and 416,100 lx h/year, respectively. Compared to the recommended limit (600,000 lx h/year) by the IESNA (2011), the value of the SMCCU case is considered unsafe, while the value of the HHM case is considered safe.

When compared to the recommended limits by the CCAHA (50,000 lx h and 100,000 lx h for the high sensitivity and low sensitivity categories, respectively), the results showed much higher values than these limits (i.e., unsafe). The CCAHA limits are based on paper exhibition; that is why, it is more stringent. Thus, one should take the CCAHA recommended limit into consideration if the room will be mainly used for paper artifacts; otherwise, the recommended values by the IESNA do not indicate any possible risks.

4.5 Direct Sunlight

Direct sunlight can cause permanent damage to the display artifacts; thus, protection measures are to be taken to make sure that no direct sunlight will hit any artifact in any circumstances. One way to overcome these problems is to exclude the direct sunlight and to control its exposure time. Intelligent systems with sensors that control the shutters of windows and control the opening time can help keep the museums' artifacts within safe light exposure limits. Using local trees to shade windows could be another effective solution. This was confirmed by the main author in previous research (Al-Sallal and Abu-Obeid 2009; Al-Sallal and Ahmed 2007), which showed that shading by local trees could reduce the overall levels of illuminance by 18–96%, depending on the room orientation. Shading by trees is highly recommended due to several other advantages. First, it will help in minimizing the possibilities of glare and visual discomfort problems. Second, it has no harm on the heritage character of these buildings—not like other solutions that might look odd. Third, it will help minimize building's cooling loads, energy consumption, and greenhouse gas emissions.

5 Conclusion

Carrying out measurements on-site helped study the exhibit spaces in their actual surroundings and understand the characteristics of the interior surfaces. Comparing the simulated measurements with the actual ones also helped calculate the accuracy of the simulation results (estimated as ±4%). Two differently configured exhibit spaces with the same style of windows (traditional Dreesheh windows) and same WWR (12%) were investigated in this study, under the sky conditions of UAE. Several issues were discovered as a result of the thorough annual daylight simulation analysis that was done for the exhibit areas (these issues were associated mainly with horizontal displays). Recommendations were also provided in response to the daylighting issues without compromising the architectural character. Issues that are most significant can be pointed out as follows:

- Daylight autonomy (DA): The highly shaded exhibit room of the HHM case performed better than the no shading room of the SMCCU case for the low sensitivity category (48% difference in spatial DA between the two cases). It also did not record any illuminance readings greater than 1000 lx (0% spatial DA), compared to the HHM room that recorded 23% spatial DA. Both cases did not perform well with regard to the high sensitivity category, which suggests that more effective methods of shading are needed for this category.
- Useful daylight illuminance (UDI): The UDI results indicated that the highly shaded room of the HHM case was safer than that of the SMCCU safe for both the high sensitivity and low sensitivity categories ($UDI_{<100\ lx}$ of 21% versus $UDI_{<100\ lx}$ of 0%). The zero value of the $UDI_{(>2000\ lx)}$ in the highly shaded room of the HHM case also indicated a high level of safety with regard to sunlight exposure.
- Artifacts exposure to light: The exposure to light results indicated that the tested exhibit spaces of the SMCCU and HHM cases are unsafe for the high sensitivity category, especially in the zone from the windows to at least the center of the room. Shading and daylight distribution elements such as light shelves or louvers should be considered. The results for the low sensitivity category indicate that the exhibit space in the SMCCU is unsafe from the window to at least the center of the room, while the exhibit space in the HHM case is safe from at least the center of the room and the back wall.
- Direct sunlight: Direct sunlight must be prevented from entering the display areas since it can cause severe damage to the artifacts and reduce the visual comfort of the visitors. To achieve this, one should keep the shutters of the windows closed during the direct sun hours, especially during morning time.

The calculated light levels in the two tested exhibit areas were much higher than the recommended values for museum use. Some artifacts are highly susceptible to damage if exposed to high illuminance levels. Therefore, based on their sensitivity to light, some precautions must be taken in order to protect them from permanent damage. The use of veiling structures such as shading devices or landscape elements on the interior/exterior of the openings must be used to control daylight access to the space. Nonetheless, using local shade trees is a more desirable option, since they will not affect the architectural character in any manner and will add environmental benefits as well as aesthetics to the area. The above-suggested solutions need to be studied in upcoming research, for example, how native shade trees contribute to and affect lighting in heritage museums and how they benefit solar shading and passive cooling. Other potential research topics are the study of operating window shutters at particular times throughout the day, the effect of altering the reflectance of the internal surface, and the impact of re-organizing the furniture within the exhibit area.

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Part III
Material Techniques

The author of the first chapter of this part, "Rural Architectural Characteristics and Conservation Issues of Alaaddinbey Village In Bursa, Turkey," uses Alaaddinbey, a small rural hometown located in the northwest of the Uludag Mountain in Nilüfer, as a case study. The author argues that traditional houses in areas like Alaaddinbey are at risk of demolition because of zoning stress, changing lifestyles, and lack of legal protection. Therefore, analyses of the traditional urban pattern of the village, plan and facade characteristics, construction techniques, and building materials of traditional houses were carried out.

In chapter fifteen titled, "Historical Urban Fabrics and the Effect of New Building Shadings on Social Activities—Case Study Tripoli Lebanon," the authors explain that the Middle East has historical cities with a very rich and unique urban fabric. However, these cities did not follow the paths of rapid urban changes taking place anywhere. The authors used Tripoli, a city in Lebanon, as their case study because of its distinct urban planning that has not changed since the Mamluk period. The aim of this chapter is to observe and analyze the effect of new buildings within the historical urban fabric on the environmental needs of users in terms of shaded spaces, with Tripoli in Lebanon providing a case study.

The final chapter in this part, titled "Upgrading Local Laws for the Conservation of Heritage in the Light of International Charters and Conventions," addresses the importance of employing rules and regulations that govern the process of conserving architectural heritage. The author of this chapter aims to impose a specific mechanism to develop local laws and legislation, maximize their benefit, expand their implementation, and identify deficiencies in local laws and legislation in Egypt.

Rural Architectural Characteristics and Conservation Issues of Alaaddinbey Village in Bursa, Turkey

Elif Acar Bilgin

Abstract

Alaaddinbey is a small rural hometown located in the north-west skirts of Uludag Mountain, in Nilüfer, Bursa. It was a waqf village that Orhan Gazi had given to his brother Alaaddin Bey. Alaaddinbey Village is one of the rural areas that represent the architectural characteristics of traditional houses in Bursa. At present, new residential and industrial buildings take place in surroundings. Traditional houses are under risk of demolition and vanish because of zoning stress, changing lifestyles and lack of legal protection. In this paper, the traditional urban pattern of the village, plan and facade characteristics, construction techniques and building materials of traditional houses were analysed. The causes of decay of buildings and conservation issues were studied, and recommendations were developed for conservation and survival of traditional houses and urban pattern.

Keywords

Rural architecture • Vernacular architecture • Adobe buildings • Bursa • Alaaddinbey

1 Introduction

The structure of the houses in Anatolia was shaped by the effect of Turkish–Islamic family lifestyle, domestic work of women in daily life and the privacy of family life in Islamic society. A courtyard or inner garden facing the inside was designed on the ground floor. The daily routine of women, like washing, cooking, fruit/grain and drying, shaped the ground floor. The main areas of the upper floor were the rooms, iwan and the anteroom. The rooms were multifunctional, arranged in a way to respond to the needs of seating, sleeping and dining (Kuban 1995).

The diverse vernacular architecture in Turkey is formed by different geographical and climatic conditions in every region by means of material choice, architectural style and constructional techniques. Doğan Kuban divided the residential architecture of Anatolia into seven regions according to construction systems and local building materials in his speech "Observations on the Turkish House Tradition" made for the first time in 1971. The various construction systems, influenced by climate and geographical conditions, are similar to cross-border geographical areas of Anatolia such as South Caucasia, North Syria and the Balkans. These regions are (a) masonry houses in Southeastern Anatolia; (b) stone wall with bonding timber houses in Eastern Anatolia; (c) wooden construction houses in the Eastern Black Sea region; (d) cubic stone houses in the Aegean and Mediterranean region, (e) masonry houses in Central Anatolia (Cappadocia); (f) adobe houses in Central Anatolia; (g) timber frame with adobe filling in the north-eastern coastal area and spreading from the North Taurus Mountains to the inner Aegean area. He characterized the timber frame with filling (originally *hımış*) technique as a housing culture developed by the Turkish Age in Anatolia (Kuban 1995).

Bursa is one of the cities located in north-eastern coastal area of Anatolia where the traditional houses include significant examples of timber frame with adobe filling construction technique. The two houses that are still surviving

"Waqf: A grant of land or other sources of revenue given in mortmain for pious or charitable purposes as well as the organization taking care of those properties" (Bursa Site Management Unit 2013). Also, waqf means a foundation system that is used in Ottoman Period to provide a source of income or a property given to legal entities for charity works (Hasol 2008). For example, Alaaddinbey village's taxes were used to build a mosque in the name of Alaaddin Pasha in old city of Bursa. Another example is a World Heritage Site Cumalıkızık Village belongs to Sultan Orhan foundation, and taxes were used to build the Orhan Gazi complex in the city centre.

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today and well-known examples that best describe the architectural style of the traditional housing are the Murat II House and Hüsnü Züber House [referred to as Abdulvahap House in the book of Turkish House of Eldem (1984)] located in the district of Muradiye (Figs. 1, 2 and 3).

The Cumalıkızık Village in Bursa, which was inscribed into the World Heritage List in 2014, is one of the best-preserved rural areas of Turkey. At present, street rehabilitation and restoration works have still been continuing. The villagers have started to earn income by in-house food production for tourism (Figs. 4 and 5).

Köprülü Bağbancı (2016) proposed a sustainable protection and survival model for Cumalıkızık Village. This protection model is comprised of a three-party team: a technical team consisting of expert architects and engineers in the field of restoration, a Cumalıkızık Building Repair Cooperative to be run with collaboration between the local people, managers and technical team, and a management team including the local government and ministries.

In rural areas, local people are not aware of the significance of cultural assets and do not apprehend the necessity of preservation of architectural heritage. The inner place quality of traditional houses does not meet the needs of modern lifestyle because the old houses do not have a modern

Fig. 1 Front façade of Murat II House

Fig. 3 Hüsnü Züber House

Fig. 2 Interior view of Murat II House

Fig. 4 Town square of Cumalıkızık Village

Fig.5 Timber houses in Cumalıkızık Village

bathroom or kitchen inside. Besides, as the result of internal and external immigration after the 1950s and 1980s, the houses were abandoned, neglected and destined to collapse. The protection problems of traditional villages can be generally categorized as social problems, economic problems, architectural problems, technical implementation problems and legal problems. The role of architects in the protection of examples of rural architecture is significant in adapting to the current needs, without losing the authenticity of the traditional house and finding solutions with modern techniques specific to the locality, such as the earth-sheltered houses. In addition, legal protection by registration, with the detailed documentation of the houses and contribution to the relevant literature, can make it possible to share information with the public and attract attention to the rural areas (Eres 2016).

The Nilüfer District hosts the biggest industrial zone and also small industrial and commercial zones in the central city. The villages of Nilüfer have rapidly been urbanizing due to the effects of the industrial zones nearby, and their traditional urban pattern has been lost and deteriorated, and traditional houses have been disappearing. Within this context, Alaaddinbey Village was chosen to examine because this village is facing these problems mostly. Also, the village is being used as a transitway between industrial zones, and this situation exacerbates the deterioration of its pattern. Local people tend to sell their land with high rents to leave the village or demolish the "old" houses to build a new apartment. Nilüfer Municipality has a project of "Allotments used for Agricultural Purposes" and established hobby gardens in Alaaddinbey to hire and cultivate these horticultural gardens (Nilüfer Municipality 2017). This project increases the recognizability of village and can be utilized for the preservation of Alaaddinbey. The purpose of this study is to document the rural settlement, which is not under legal protection and which has been losing its traditional pattern due to such reasons as abandonment, dysfunction and neglect.

As the first part of this research, a field survey[1] was conducted. The buildings located in Alaaddinbey were classified as new and traditional constructions. The traditional ones still preserving authenticity were given a number on the map, photographed and documented according to their architectural features. Within the scope of this study, two buildings are selected, representing the vernacular architecture and rural lifestyle of the village and settling, plan, façade characteristics and construction techniques are explained in detail. The physical changes and alterations in the settlement were identified. The reasons for the deterioration of traditional texture were researched, and the opportunities of preserving and maintaining the traditional houses within the existing conditions of the village were discussed.

2 History and Economy of Alaaddinbey Village

Alaaddinbey District is located in the north-west skirts of Uludağ Mountain in Nilüfer. It lies between the İzmir Highway Street in the north and Bursa–Balıkesir Highway in the south (also known as Çalı Road). In the immediate vicinity, there are villages and industrial zones such as Küçük Sanayi Industrial Zone, Nilüfer Trade Center and Çalı Industrial Zone (Figs. 6, 7 and 8).

The Alaaddinbey Village, formerly known as "Fodra", is also known by the name "Erikli/Erihli". This village is a waqf village of Alaaddin Pasha (Orhan Gazi's brother) and took its name from him. During the Ottoman Period, it was connected to the Town of Kite (Ürünlü) and mostly Roman people lived there. After the Ottoman–Russian war of 1877 and 1878, a small group of Balkan immigrants was placed here (Kaplanoğlu 2001). Alaaddin Bey built a few waqf buildings in Bursa by collecting the tax revenues arising from the production proliferation of the nomadic nomads and the villagers. Today, there are a mosque, a public bath (hamam) and a madrasah in Alaaddinpasa District in Hisar the old city centre (Ulutaş 2014).

[1]The field study was carried out by the author during April and May in 2017. The case buildings were later examined and measured in June 2017. After the rainy season, early summer days were chosen particularly for the case study in order to see the latest condition of the damaged buildings located in the moderate climatic region of Turkey.

Fig. 6 Location of Alaaddinbey Village and its immediate environment (https://yandex.com.tr/harita/)

Fig. 7 Aerial photograph of Alaaddinbey Village (https://yandex.com.tr/harita/)

In the second half of the nineteenth century, sericulture became one of the important sources of income of the village. In Alaaddinbey, it was agriculture and animal husbandry that played a vital role in the economic situation and everyday life in the fertile soil cultivated for centuries. Wheat, sunflower, tobacco and beetroot were produced; fruit and vegetables were grown as well. Settlements increased within the last 15–20 years, and due to the influence of the nearby industrial areas, most of the agricultural lands of the Alaaddinbey Village were transformed into trade and industrial areas. In the village, the young population decreased and the average age increased, since the young population of the village moved to the city centre or nearby industrial districts for job opportunities (Ulutaş 2014). Today, agriculture and animal husbandry is continued in the Alaaddinbey Village by the families for only domestic use. Individual chicken breeding and animal farms are other sources of income for local people.

3 Architectural Analysis of the Traditional Texture of Alaaddinbey Village

3.1 Traditional Urban Texture and Houses

The mosque in Alaaddinbey and the square in front of it constitute the core of the settlement. In this square, there are public-use areas such as coffee house, office of the local authority and grocery. The texture of the settlement is composed of the organic streets, dwellings and large green areas. The gardens contain outbuildings such as stables, haystacks, toilets and woodshed. The houses are usually two storeys; outbuildings are single storey. Also, there are new two- to three-storey apartments in the settlement (Fig. 9, Table 1).

Fig. 8 General view of Alaaddinbey Village (Ulutaş 2014)

Fig. 9 Buildings, roads, green areas and traditional houses in Alaaddinbey (Reproduced from the site map obtained from Nilüfer Municipality Archive)

Table 1 General properties of traditional buildings

Building code	Typology	Plan (first floor)	Facade	Construction	Current use	Current state	Originality	State of registry
Building 1	House with backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Office + residential	Livable	Partially original/facade is altered	Not registered
Building 2	House with sideyard and backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Livable	Original	Not registered
Building 3	House with backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Partially damaged	Partially original	Not registered
Building 4	House with sideyard and backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Partially damaged	Facade is altered/large windows are added	Not registered
Building 5	House with sideyard and backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Partially damaged	Original/large windows are added	Not registered
Building 6	House with sideyard and backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Residential	Livable	Facade is plastered with cement	Not registered
Building 7	House with sideyard and backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Livable	Original	Not registered
Building 8	House with backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Partially damaged	Original	Not registered
Building 9	House with sideyard and backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Damaged (roof is partially collapsed)	Original	Not registered
Building 10	House with backyard	Partially closed anteroom	Adobe plaster	Timber frame mud brick filling	Commercial	Livable	Original	Not registered
Building 11	House with backyard	Partially closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Partially damaged (first floor is partially collapsed)	Original	Not registered
Building 12	House with sideyard and backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Partially damaged	Original	Not registered
Building 13	House with backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Partially damaged	Original	Not registered
Building 14	House with backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Partially damaged (roof is partially collapsed)	Original	Not registered
Building 15	House with sideyard and backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Livable	Partially original	Not registered
Building 16	House with sideyard and backyard	Closed anteroom	Adobe plaster	Timber frame mud brick filling	Not occupied	Partially damaged	Original	Not registered

3.2 Relationship Between Street, Garden and Housing

The buildings were built in detached or adjoined order. All the houses have a garden. The buildings have two different typologies in terms of their location in the parcel and their relation to the garden:

House with a Backyard: The building is accessed directly from the street by a door, and the backyard is accessed from inside the building. In some buildings, there is a second larger door for the entrance to the garden in addition to the main entrance door (Buildings 1, 3, 8, 10, 11, 13, 14).

House with a Side Garden and Backyard: There is a garden on the side and back of the building. The side garden is accessed by a door from the street and into the building itself. In these types of examples, the building does not have a street door. On the ground floor, there are also examples that do not have a window opening to the street (Buildings 2, 4/5, 6, 7, 9, 12, 15, 16).

3.3 Plan Characteristics

According to the Turkish House Plan Typology of Eldem (1984), the houses in Alaaddinbey are the examples of houses with an outer anteroom. The anterooms on the first floor are closed. There are also examples where the anteroom is partially open. During the period when they were built, the anterooms and the rooms were built larger to use for sericulture. The fact that it was a settlement where agriculture and animal husbandry was done was reflected in the plan type. For example, near the main house door, a larger door was arranged for animals to carry loads to the backyard easily. Toilets are located on the ground floor; service spaces such as woodshed, stables, haystacks, oven and coops are located in the garden. So, the ground floors of the buildings were built in relation to the garden in daily rural life. In some houses, a toilet was built on the first floor in the form of an attachment on the anteroom front. In addition, alterations such as cupboard niche and dish drainer were built.

3.3.1 Case Study 1 (Building 7)

The building located at the corner of Alaaddinbey and Aralık streets has a side garden and a backyard. The building is accessed from the street through that garden. In the garden, there are a coop, a woodshed covered with a porch and an oven (Figs. 10, 11, 12, 13 and 14). At present, the house is out of use. The owners of the house live in a new apartment near this building, and they are still using only the outbuildings.

There are an entrance courtyard (originally *taşlık*), a room and a stable on the ground floor. The room was built at a higher level than the entrance courtyard. There are two windows on the wall of the room facing the street. There is no covering on the ceiling of the ground floor, so wooden beams are visible (Fig. 15). On the first floor, there are an anteroom facing the backyard and three rooms facing the

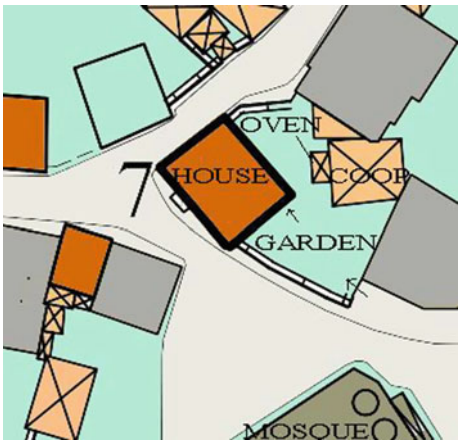

Fig. 10 Site plan of Building 7

Fig. 11 Areal photograph of Building 7 (https://yandex.com.tr/harita/)

Fig. 12 Front facade of Building 7

Fig. 13 Adobe garden walls of Building 7

Fig. 14 Anteroom at the first floor

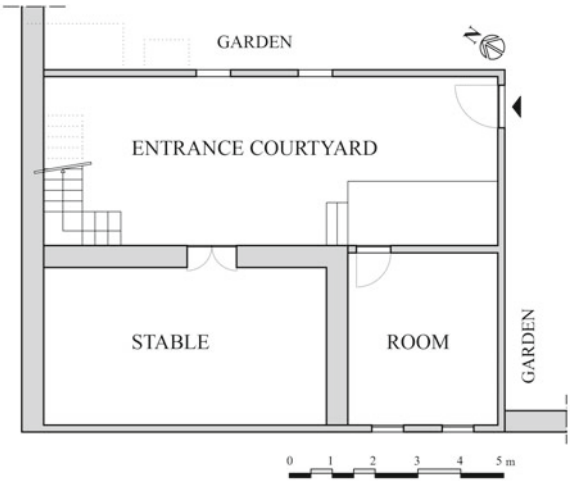

Fig. 15 Ground-floor plan. *Source* The author

street. There is no ceiling covering of the anteroom; the roof construction is visible. A toilet, cupboard niche and a dish drainer were arranged on the north-west wall of anteroom like a cantilever. The windows of the rooms overlook the street. Rooms have timber covered floors and ceilings (Fig. 16).

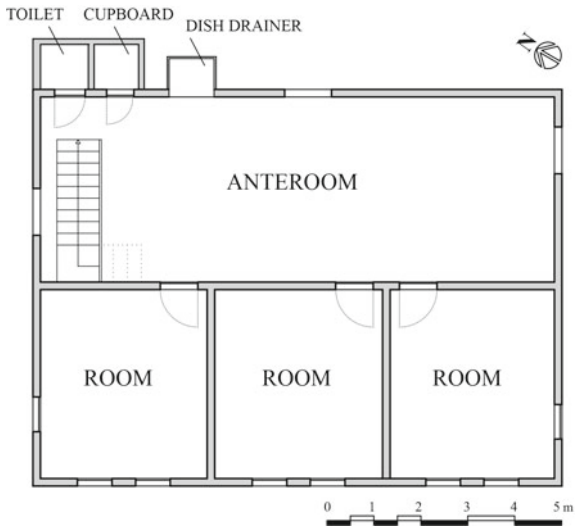

Fig. 16 First-floor plan. *Source* The author

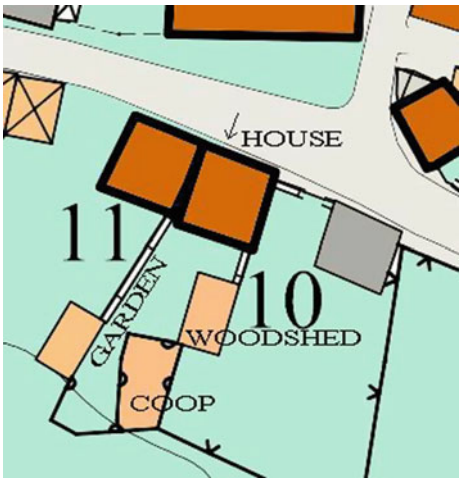

Fig. 17 Site plan of Building 10

3.3.2 Case Study 2 (Building 10)

The building located on Alaaddinbey Street has a backyard. The building is accessed from the street, and it is possible to reach the backyard by passing through the entrance courtyard of the building on the ground floor (Figs. 17, 18 and 19). In the backyard, there are a coop, a woodshed under the porch and an oven.

At present, the building is not used as a residence. The garden is being used for poultry rearing; the ground floor is used as a marketplace for agricultural products such as eggs and fruits. On the ground floor, there are one room, a toilet and a kitchen counter annexed to the hall. A new large window was later opened on the wall of the room facing the street. There is no covering on the ceiling of the ground floor, and wooden beams are visible. There is not any door

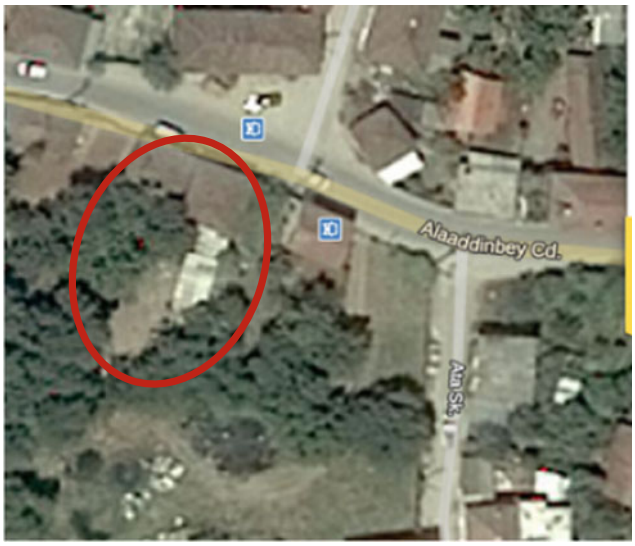

Fig. 18 Areal photograph of Building 7 (https://yandex.com.tr/harita/)

Fig. 19 Front facade of Building 7

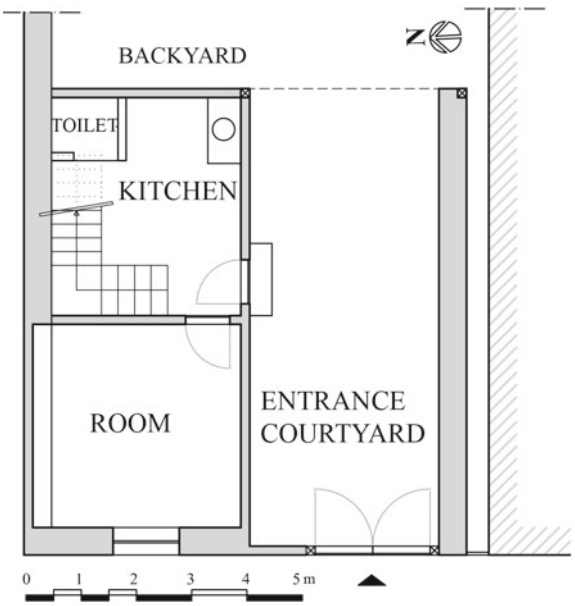

Fig. 20 Ground-floor plan. *Source* The author

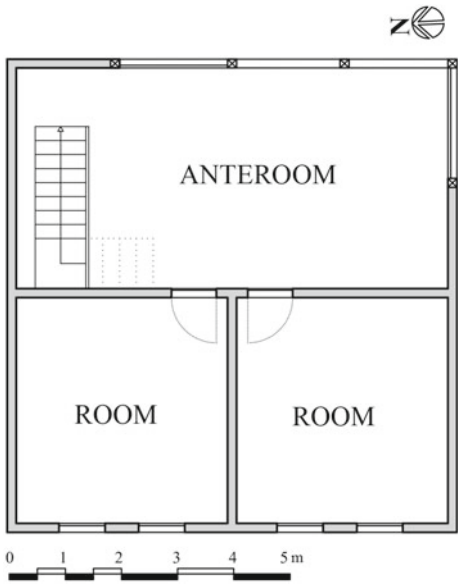

Fig. 21 First-floor plan.

between the entrance courtyard and backyard. The entrance courtyard is a transition space between street and backyard. On the first floor, there are two rooms facing the backyard and the anteroom facing the street. There is no ceiling covering of the anteroom, so the roof construction is visible. Some parts of the open anteroom are covered with wooden boards. The rooms have two windows facing the street. Floors and ceilings are covered with wood (Figs. 20, 21, 22, 23, 24 and 25).

3.4 Façade Characteristics

The facade characteristics of a traditional Turkish house are also visible in the village of Alaaddinbey. There is no window facing the street in the ground-floor walls of the houses. But, new windows were opened on the walls of the ground floor depending on new uses over time. On the first floor, each room has a double window facing the street. The oriles were arranged in different forms related to the parcel that the building was located. There are also examples where the chimney is built like a cantilever on the façade. The exterior walls of the buildings are plastered with adobe. Front façades are plastered, but side façades of some buildings are not. Plastered facades have band mouldings. The roof was constructed with timber trusses and rafters and

Fig. 22 Entrance courtyard

Fig. 23 Backyard and back façade

roof boarding covered with gutter tile. There are no eaves fascia, rainwater piping and wooden covering under the eaves.

3.5 Construction Techniques and Building Materials

The building materials used in the traditional Alaaddinbey houses are wood, stone, adobe and mudbrick. The buildings were built on stone bases elevated from the road level. As the road level rose over time, the foundations of the buildings were partly buried. Both floors of the buildings were built with mudbrick-filled timber frame technique. Some walls on the ground floor are made up of stone rubble.

Fig. 24 Entrance of rooms at first floor

Fig. 25 Anteroom room at first floor

In some buildings, the walls were built with mudbrick masonry, strengthened by bonding timber. The facades are plastered with adobe or unplastered (Figs. 26, 27, 28 and 29).

Fig. 26 Mudbrick wall and timber construction

Fig. 27 Timber construction with mudbrick fillings

Fig. 28 Construction details

Fig. 29 Dilatation joint between two timber construction

The floor beams, stairs and ceilings are made of wood (Fig. 30). The original form of ceiling of the ground floor is uncovered, so the floor beams are visible (Fig. 31). There are some examples that anterooms that have no ceiling, and the timber roof system is visible (Fig. 32). The ceilings of the rooms are covered with wood (Fig. 33).

Outbuildings such as stables and haystacks were built one storey, as independent units. Pillars carrying wooden roofs were filled with mudbrick. Some of them were built with mudbrick masonry technique that also carry the timber roof (Figs. 34 and 35). The ovens in the garden are covered with a porch. The ovens were built with mudbrick, plastered with adobe and have a porch over it (Figs. 36 and 37).

Fig. 30 Wooden stairs

Fig. 31 Wooden beams on the ceiling

3.6 Architectural Elements

It was observed in the buildings examined that the original entrance doors were mostly monoplane or double-leaf panelled wooden doors. There are examples of houses with two separate doors: one for entering into the house and the other

Fig. 32 Timber roof seen above the anteroom

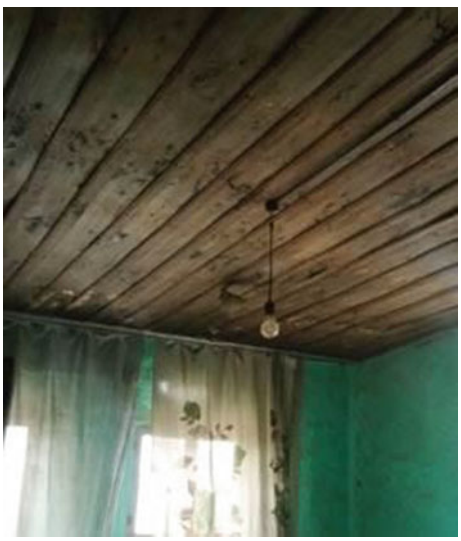

Fig. 33 Wooden covered ceiling of the room

for animals and horse carriages (Figs. 38 and 39). Casement windows were more commonly used. There are also examples where the hung windows and casement windows were used together, as well as long-span, casement wooden windows (Figs. 40 and 41).

The cantilevers were arranged in rectangular and triangular forms (Figs. 42 and 43), and the floor beams were elongated and supported with props (Figs. 44 and 45). If the parcel is in an irregular form, triangle or rectangular cantilevers were preferred to create a rectangular plan schema at first floor. The fact that the house number 13 has a semi-circular planned chimney in the middle of the cantilever on the front façade is the only example that has survived today in Alaaddinbey (Fig. 46).

Fig. 34 Mudbrick of a haystack

Fig. 35 Mudbrick walls of a stable

4 Reasons for the Deterioration of the Traditional Texture and Conservation Issues

The main reasons for the deterioration of the traditional texture in Alaaddinbey are neglect and abandonment. The old and partially destroyed houses have not been repaired, and the deterioration process has been accelerated due to abandonment. Alaaddinbey Village is not under a legal protection as a rural site, and the buildings are not registered.

Unqualified repairs were done in the buildings that are being used for housing or other purposes. The adobe plaster of façades was renewed with cement plaster. The roofs were repaired using new materials instead of traditional materials and lost their authenticity. Besides, there was a partial collapse on the roofs. The original wooden entrance doors were replaced with iron doors. Facade and woodwork repairs are made by owners that are still in use. Since these repairs were made with new materials, not original materials and

Fig. 36 Adobe-plastered brick oven

Fig. 37 Adobe-plastered brick oven

Fig. 38 Wooden door

Fig. 39 Two wooden doors for people and animals/carriages

techniques, the buildings lost their authenticity (Figs. 47, 48 and 49).

Since the stone bases of the buildings were under the rising road level, the mudbrick walls were waterlogged from the road. The mudbrick plaster and fillings fell off, and the wooden-bearing elements were decayed (Fig. 50). The lost mudbrick fillings were repaired with new materials such as briquettes and perforated bricks (Fig. 51). The original window sizes were changed; woodwork windows were replaced with plastic windows. All these repairs caused buildings to lose their authenticity (Fig. 52).

Fig. 40 Four-leaf wooden window

Fig. 41 Wooden window with two big and two small leaves

Also, increasing rents and building pressures, due to the industrial zones around the village, cause new housing on the fields of village. Some of the villagers live in the new houses they built in place of the demolished traditional

Fig. 42 Rectangular cantilevers arranged on both two facades supported with wooden buttress

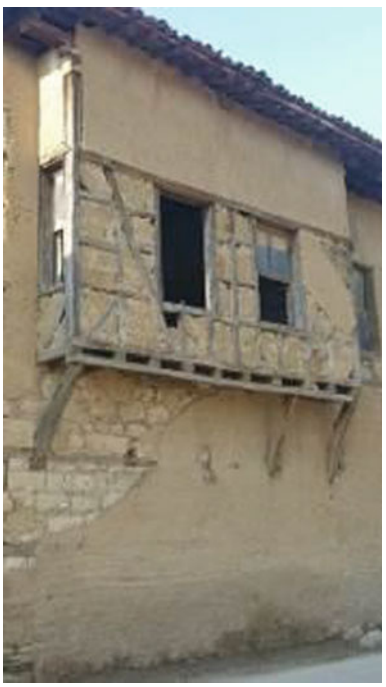

Fig. 43 Rectangular cantilever and wooden buttress

Fig. 44 Signs of master on the wooden buttress

Fig. 45 A wooden buttress

Fig. 46 Semicircular planned chimney arranged like a cantilever on the facade

Fig. 47 New plastic windows on the first floor and the small shop arranged on the ground floor caused lost of authenticity

houses or in part of their garden. They have left their traditional homes, so deterioration has increased in such empty houses.

5 Evaluation and Conclusion

Since Bursa was inscribed into the World Heritage List in 2014 with its Khans District, Sultan Complexes and Cumalıkızık Village, the tourism potential of the city has increased

Fig. 48 New plastic windows and cement plaster on the wall

Fig. 49 New metal entrance door of the building

Fig. 50 Loss of fillings and plasters

Fig. 51 Improper materials on the walls

Fig. 52 Inappropriate changes of windows

at international level. Cumalıkızık, the only rural World Heritage Site of Bursa, has created awareness regarding the preservation of other rural areas of the city of Bursa.

The inscription of a cultural asset into the World Heritage List does not diminish the value of other assets in the city. The village of Alaaddinbey is a waqf village, but it could not protect its authenticity and integrity like Cumalıkızık. First of all, legal protection must be ensured in order to preserve its current original state and stop the deterioration and destruction. In order to protect the existing traditional texture in Alaaddinbey, where the new housing constructions are increasing rapidly, a preservation development plan should be prepared and the existing buildings which have substantially managed to retain its authenticity should be registered.

Even though registration is an important step in protecting civilian architectural heritage, it still does not ensure adequate protection and documentation. For the detailed documentation of existing cultural assets, a technical team consisting of the staff from the relevant departments of the city's universities and vocational schools can be commissioned. Cooperative teamwork may be conducted under the management unit consisting of Nilüfer Municipality, Bursa Metropolitan Municipality and related ministries. Protection efforts will be conducted more strongly not only by the experts, but also with the participation and contribution of the local people, who are the actual users of the cultural heritage and its main protectors. For Alaaddinbey as well, such a local organization that will support the technical team and the management unit and express the demands of the people should be established and contribute to the protection process. The local initiative called "Gazhane Volunteers" that instigated the protection process of the Kadıköy Hasanpaşa Gashouse (Tanyeli and Aslan 2001) should be an example for Alaaddinbey.

Interventions should be determined for the preservation of the traditional texture and the sustainability of social life. Traditional houses should be restorated to preserve their technical and documentation value. Also, they must be renovated in order to meet the contemporary requirements, such as bathroom, toilet, kitchen, heating system and wastewater drainage. A sustainable development plan and design guideline should be prepared for village and local people.

The project of the Nilufer Municipality's hobby gardens (allotments) can be considered as an opportunity for the continuation of agricultural production in Alaaddinbey and the maintenance of the authentic social life. Abandoned buildings can be restored and used as residential buildings, taking into account the needs of today. As an alternative to the negative effects of the hot and humid climate of Bursa, these rural settlements within the city can be considered and used as summer residences or weekend houses because of their thermal comfort advantages. Also, the field of this village should be organized as an organic agriculture development area by local authorities. If agricultural production continues, traditional life will continue in the village and traditional houses can be survived by reuse of them.

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Historical Urban Fabrics and the Effect of New Building Shadings on Social Activities—Case Study Tripoli Lebanon

Mary Felix and Khaled El-Daghar

Abstract

As a general rule, the historical cities in the Middle East have a rich and unique urban fabric. However, due to rapid changes in the architectural built environment, some of these cities have not had the chance to develop or upgrade to follow the effects of the new architectural and urban changes to fulfil the needs of new users. The historical city of Tripoli in Lebanon is among the most important Arab cities, with a distinctive urban planning, and it has not changed since the Mamluk period. The urban fabric of the old city is historical, but some of its buildings are modern and have no distinctive architectural or historical character. Furthermore, the new, modern buildings that have been built among the old, historical buildings have different heights in comparison with the old fabric. In addition, changes have occurred in the original community structure to accommodate a new community with new needs. This differentiation in community and building heights leads to different shadings on the old pathways and streets, which has subsequently resulted in solutions being developed by the occupants of historical regions in order to meet their environmental needs in this urban fabric. Based on the above, the aim of this research is to observe and analyse the effects of urban morphology deformation, as well as a new community with new social activities, on the perception of the historical urban fabric. The focus is on shaded spaces that adapt to the urban environment in order to fulfil the new needs of the communities located there. Tripoli in Lebanon provides a case study.

Keywords

Historical urban fabric • Community classification • Shaded spaces

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1 Introduction

The historical urban fabric is an important aspect in the creation of the image of historical cities. The three main factors that generate the morphology of the historical context relate to buildings, community and urban aspects. The deformation of any of these factors affects the collective image of the historical city (Felix 2007; Mansour and Felix 2015). Adaptation to climate transformation in urban areas creates a complex challenge (Archer et al. 2014). If urban designers do not consider this within the old urban context, the new communities will use their own vision to fulfil their needs, which can affect the perception of the urban context.

The microclimate of historical urban outdoor spaces affects the capabilities of space usage (Lin et al. 2010; Makaremi et al. 2012a, b). One of the aspects that has an effect on urban space usage is thermal comfort. There are numerous factors that affect the thermal comfort of open-air spaces, including air temperature, wind speed, relative humidity and solar radiation. (Lin et al. 2010). The built environment directly influences the thermal comfort of outdoor spaces, which, in turn, affects the user habitation and activities of external spaces. Shade plays an important role in evaluating pedestrian-friendly outdoor spaces in hot cities (Middel et al. 2016). Shaded spaces provide more opportunity for use, especially in the Middle East and other hot climates, so shading devices—such as trees, man-made elements or building shading that can block solar radiation—are very important for designing a usable outdoor space (Lin et al. 2010).

This paper discusses the morphological historical context factors of old Tripoli in Lebanon through an analysis of the factors affecting context morphology, namely urban planning deformation, building changes and the originality of communities. Specifically, it studies the effect of morphological deformation on environmental adaptation for the user, in terms of shaded devices located on a specific path in the old centre of Tripoli in Lebanon.

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2 Morphological Historical Context Factors of Old Tripoli

The main factors that affect the historical context morphology exchange can be classified within three main aspects. The first is urban planning deformation, which relates to the changes in open spaces, paths and networks over time. The second involves the historical classifications and conditions of existing buildings. The third is concerned with the originality of the communities and crafts existing within the historical context (Felix 2007).

In the following sections, the research focuses on the old Mamluk city of Tripoli in Lebanon in order to analyse the deformation of urban morphology through the three main aspects of urban planning, buildings and communities.

2.1 Old City of Tripoli and Urban Planning Deformation

Tripoli is classified as Lebanon's second capital. The two oldest parts of Tripoli are El Mina, which is located on the coast, and the Mamluk core, built surrounding the Abo Ali River. Figure 1 shows the holistic zoning of El Mina and Mamluk in old Tripoli (Gulick 1963). The two old districts were connected directly by three spine roads across an agricultural area. The new districts that were later allocated to fill the gap between the two historical parts of Tripoli have now become urban zones. Figure 2 shows the growth of Tripoli during modern times.

Before 1955, the Abo Ali River was a centre of urban settlement, and its water was used for agricultural purposes.

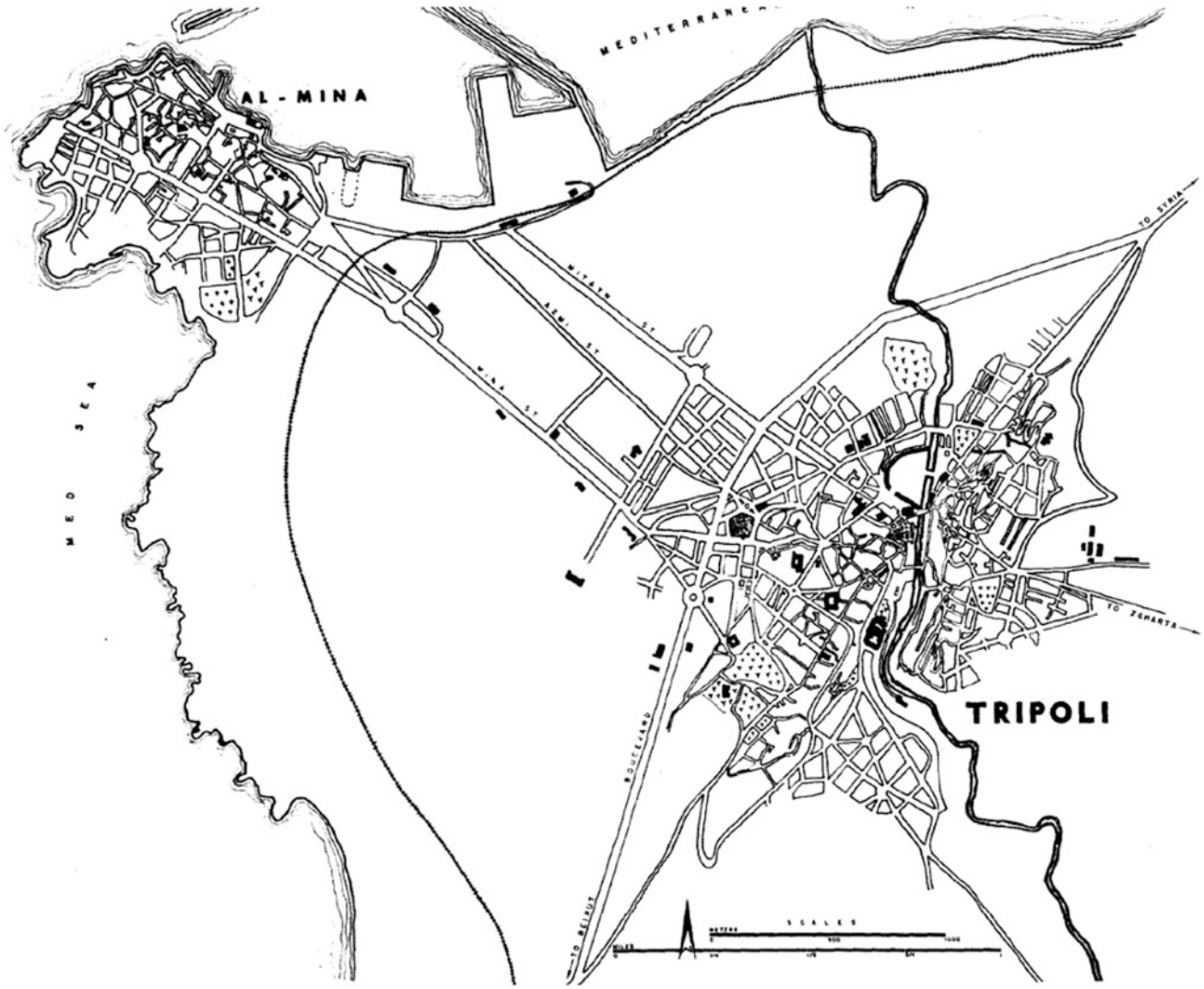

Fig. 1 Holistic zoning of El Mina and Mamluk in old Tripoli, shown as two small separated cities (Gulick 1963)

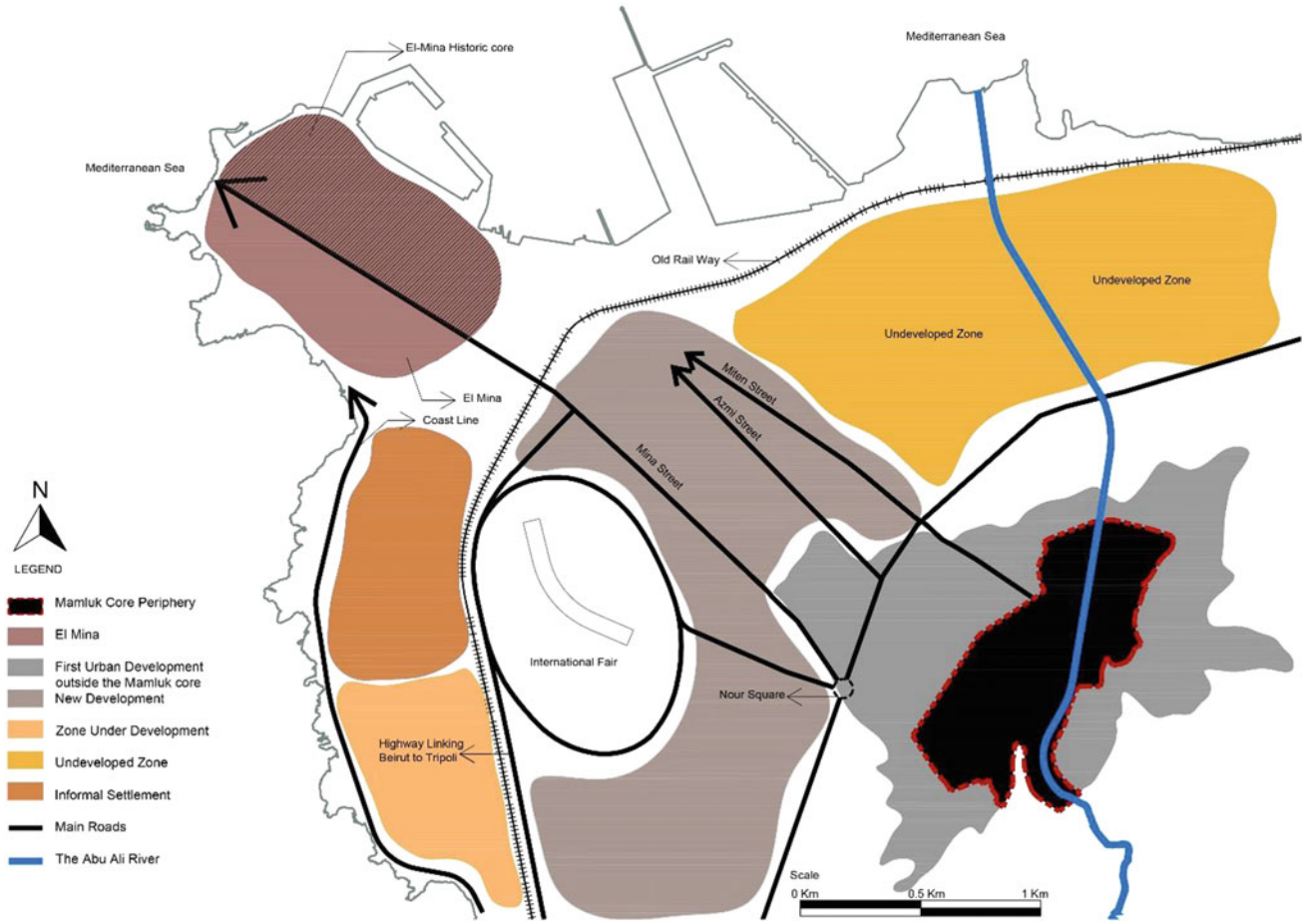

Fig. 2 Holistic zoning of Tripoli's urban zones in modern times; the two historical cities have merged into one big city (Ginzarly and Teller 2016)

However, due to the risk of flooding in 1968, a project was undertaken to turn the river into a concrete infrastructure water path, which affected the formation of the urban planning of the main paths and streets. The majority of the smaller roads within the historical urban fabric, however, are still as they were. Figure 3 shows the deformation of the urban fabric of the old Mamluk core before and after the Abo Ali River project (Ginzarly and Teller 2016).

2.2 Historical Buildings of Old Tripoli

The old Mamluk city of Tripoli consists of historical buildings from pre-Mamluk, Mamluk and Ottoman times, as well as later colonial-style buildings (Gulick 1963). In 1953, UNESCO carried out its first survey and classified 44 buildings located in old Tripoli as monuments.

Other surveys have since been carried out in 1984 and 1995, by individuals, local institutes and municipalities, to cover not only the monuments of the old city but also the valuable buildings and other features, such as fountains and gates, around the old city. The list of protected monuments increased to 190 and counted residential edifices and smaller structural elements, such as fountains, porticos and others, in its number (CDR 2001). Figure 4 shows the distribution of historical buildings in old Tripoli according to the survey in 1995 (Ginzarly and Teller 2016). However, due to a number of factors, including the war periods, the deterioration of heritage management, the high population density and pollution, a large number of heritage and historical buildings have deteriorated to varying levels. Furthermore, many valuable buildings have been destroyed and then restored using new materials that are unrelated to the original urban fabric. Some buildings have ground floors made of stone, while the storeys above have been built using new materials without considering the original urban heights and identity.

2.3 Communities of Old Tripoli

The communities of historical cities can generally be divided into three main categories relating to the compatibility between the historical urban fabric and the existing community and crafts. The first is the original community,

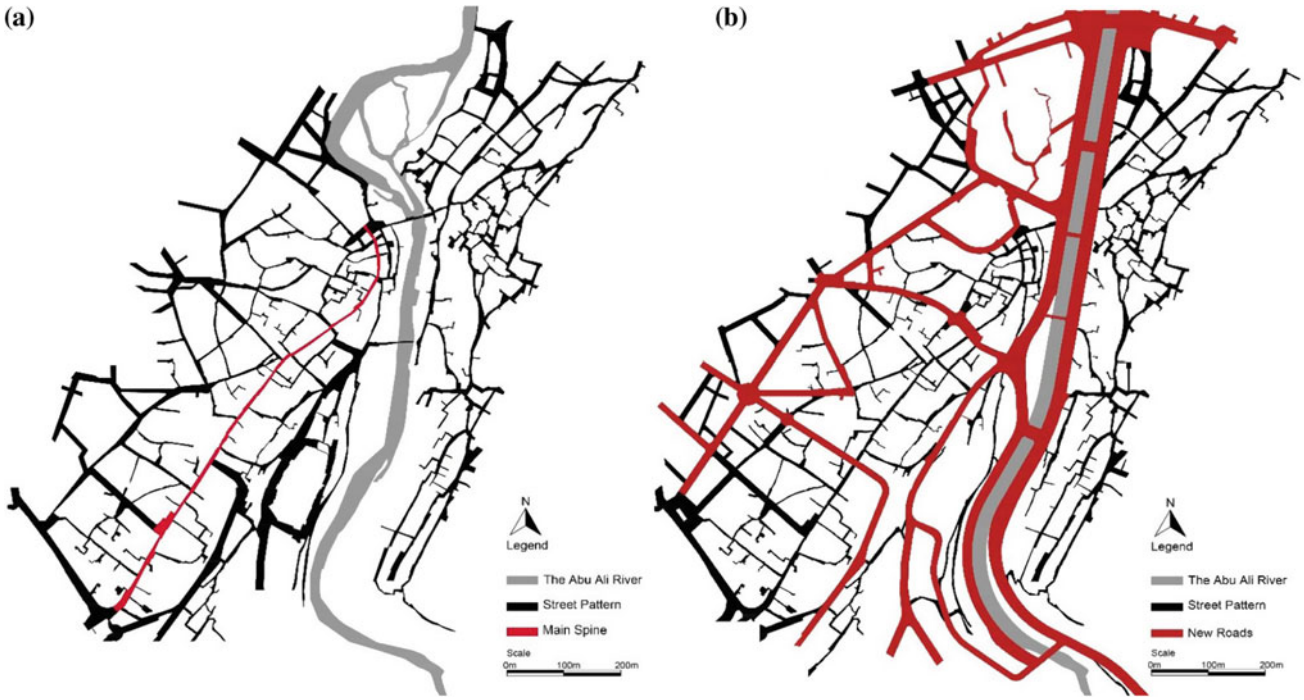

Fig. 3 **a** Street pattern of the Mamluk core in 1937 (Ginzarly and Teller 2016); **b** the street pattern of the Mamluk core after 1971 (Ginzarly and Teller 2016)

consisting of the old traditional crafts, habits and constructions. The original community can be described as the human heritage of cities, which should be conserved and developed (Felix 2007). Second is those compatible new communities that can reuse and rehabilitate the old historical buildings; these communities were not originally part of the city, but they can form an adapted part of the heritage by encouraging the ability to understand the sensitivity of the historical spaces (Sayed 1994). Third is the incompatible new community, located within the historical urban contexts rather than within the original community. As a result of the urban inability of old cities to cater for the needs of the present users, the original community allocates areas for new cities, leaving the historical context to attract different occupants who are only looking for shelters to live in. These types of community can prove very dangerous for heritage cities due to polluting crafts or the careless attitudes of the new communities towards the historical urban contexts (Felix 2007; Elloh 1983).

The Mamluk city of Tripoli consists of all three types of community. The original community is located in the souks and areas of old crafts. The compatible community restores and reuses old buildings through suitable usage. The incompatible new communities generate heritage damage through their urban additions of buildings and polluting crafts.

3 Outdoor Thermal Comfort

Thermal comfort refers to the satisfaction levels of the thermal environment, which aims to keep the body temperature at 37 °C (Epstein and Moran 2006; Nikolopoulou et al. 2001). The six main factors that affect thermal comfort are air temperature, air velocity, humidity, radiant temperature, clothing insulation and metabolic heat (Felix and Elsamahy 2017). The radiation heat load and radiant temperature are considered as the main heat stresses of outdoor urban spaces in summer (Kántor et al. 2018). In humid and hot climate zones, shading devices such as vegetation surfaces, plants, appropriate shade structures and other methods of shading can be used to decrease heat stress and to create satisfying outdoor urban spaces (Makaremi et al. 2012a).

4 Method

This research suggests a framework to observe and analyse the effect on social activities of the changing historical context morphological factors that were discussed earlier, in terms of using appropriate shading treatments. The analysis depends on an observational approach to highlighting the shading devices added, including their efficiency and effect

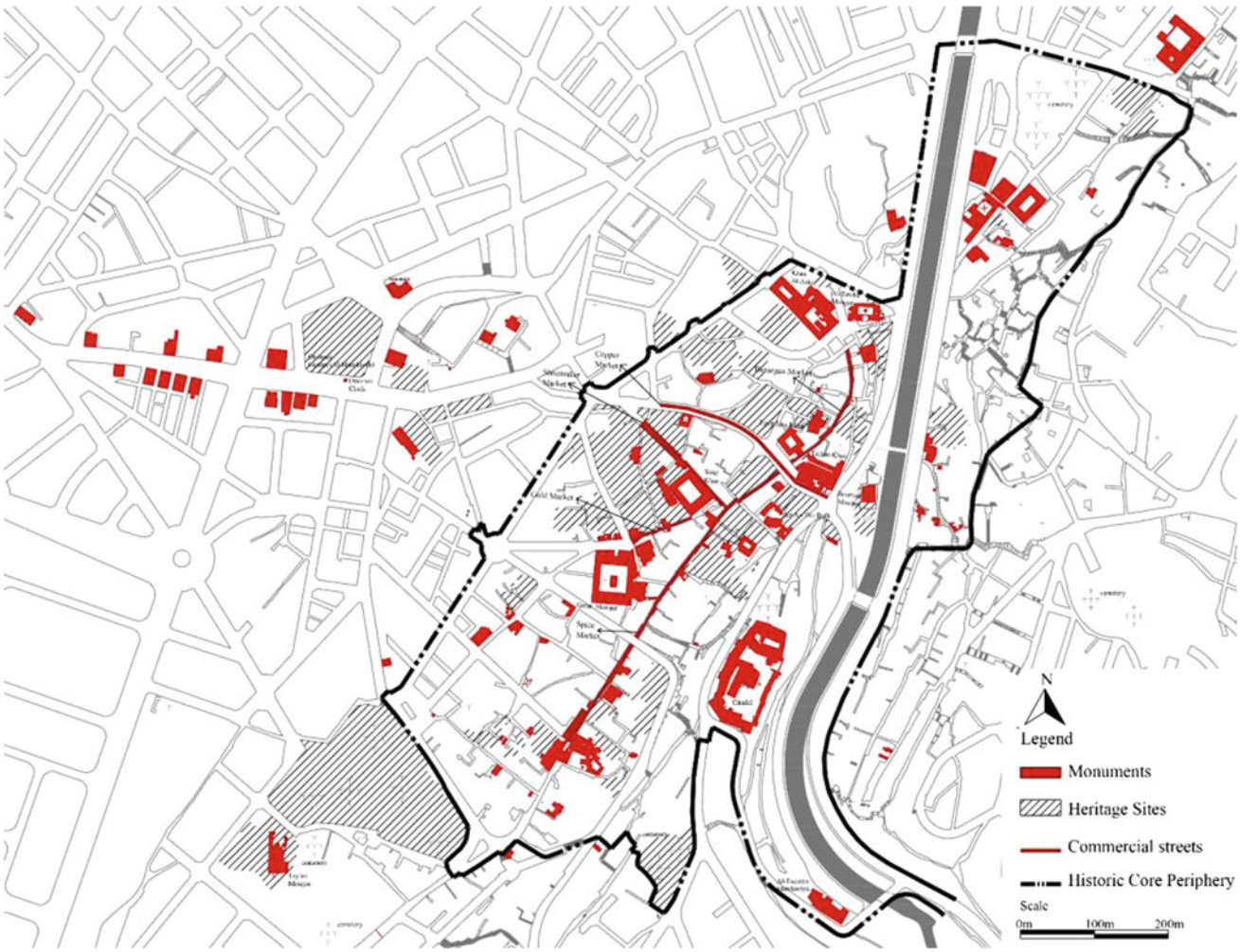

Fig. 4 Historical building distribution survey from 1995 (Ginzarly and Teller 2016)

on the context image and social activities within the case study zone, located in a core of the historical part of old Tripoli.

The suggested methodology consists of three sequential phases: first, documenting the urban context; second, analysing the buildings' shading and the areas that are exposed to heat radiation; and third, critiquing the existing shading devices and their effect on the context image and user activities.

First, the historical context morphology will be documented by surveying and observing the buildings' additions and changes, along with the originality of the community and any changes in the urban fabric. Second, the buildings' shading and shading devices will be documented and analysed through the outdoor urban space of the studied area. Third, the conflict between the efficiency of the shading devices for user activities and the effect of this shading on the historical context perception will be critiqued.

5 Case Study

The study area is located in the centre of old Tripoli, specifically on the path between El Mansour Great Mosque complex and Khan Al-Khayyateen, as shown in Fig. 5. This path is very historical and includes several monuments, markets, original crafts, and original and new communities. This path also has several types of shading devices, which will be critiqued in the following section of the research.

5.1 Documenting Historical Urban Morphology

The existing urban fabric of the surrounding area of the path is historical. The main characteristics of the urban fabric, as shown in Fig. 6, are narrow paths, compacted groups of buildings and small, open spaces.

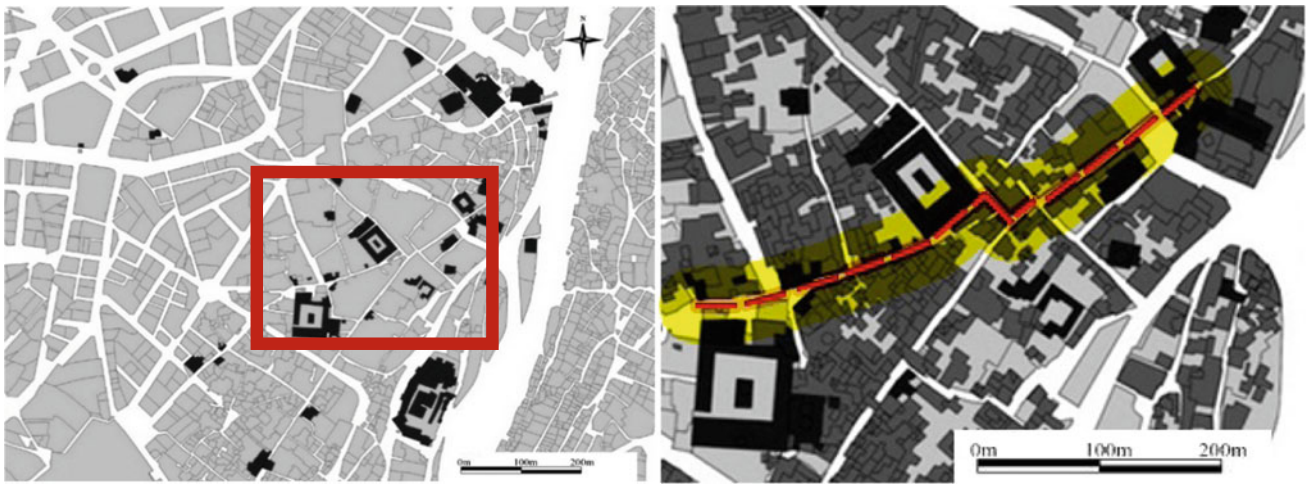

Fig. 5 Selected area of study, located on the main commercial path in the old city

Fig. 6 An urban analysis of the selected area of study—**a** small, narrow road networks; **b** composition of compacted buildings; **c** open spaces consisting of narrow paths and courtyards

The buildings that are located on the surroundings of the path include eight classified monuments: Al Mansour Great Mosque, Madrassa Al Khayriyat Hassan, Madrassa Al Nouriyat, Hammam al-Nouri, Madrassa al-Tuwashiyat, Khan Al Saboun, Khan El Misriyin and Khan Al-Khayyateen, as shown in Fig. 7. Other buildings surrounding the selected path consist of small shops and workshops plus ground floors and upper residential floors. Almost all ground floors are old, traditional buildings, but large numbers of the upper floors have been newly added over several eras. The average height of the existing buildings is between two and four floors, although a small number of buildings exceed six floors, as shown in Fig. 8.

The communities in the area of study work from 8:30 am until sunset every day, and the most crowded time is between 10:00 a.m. and 4:00 p.m. The communities located in the area of study can be classified into the three types of community discussed above. The first is the original community, which is located in small, traditional craft workshops and markets throughout the path, with trades including soap craft, sewing craft, gold craft and gold markets. The second is the compatible new community, which uses some of the old shops and unusable workshops for new commercial activities. The third is the incompatible new community, such as street vendors and some of the resident users of building dwellings. Figure 9 shows the existing uses of the buildings' ground floors.

5.2 Building Shading and Shading Devices

The reflection of the existing building heights on narrow paths generates shaded spaces in the urban fabric. On observation, there are also several types of shading devices, despite the narrow paths in the urban fabric.

The shading devices discussed in the study area can be classified into five main types: trees, constructed roofs, semi-open constructed roofs, fixed tents and textile shades,

Fig. 7 Monuments located on the path

Fig. 8 Ground floor uses

as shown in Fig. 10. These types vary in terms of materials, structure, style and perception.

5.3 Conflict Between Shading Devices, Community and Context Perception

Generally speaking, the perception of the urban context of old buildings is affected by the addition of shading devices. This section of the study will critique the effect of user activity in relation to the community classification and shading devices added to the historical urban view. Accordingly, the studied path can be divided into four zones, relating to community originality and existing shading devices.

Zone A is an entrance to the studied path, which consists of a small node. The community in this zone is an original community with a small number of street vendors. The shading devices used comprise trees and fixed tents above shop facades. The view of the buildings' elevations and the sky is clear, as shown in Fig. 11.

Zone B is an area of gold markets and shops. This zone has an original community, through the shop owners, and the shading devices are historically constructed roofs. Some

Fig. 9 Variations in building heights

Fig. 10 Location of different types of shading devices on the selected path

of the shaded roof devices are totally closed, while the others are semi-open. The constructed roofs partially block the view of the upper floors of the surrounding buildings. Due to the efficiency of roof shading and the originality of users, there was no need for any extra shading devices to be added in this space, as shown in Fig. 12.

Zone C is a commercial area. The communities in this area are totally new, and they consist of the two main types of 'new community' classification. First, the compatible new community comprises a small number of shop owners. This type does not use the street path for any activity or add any new shading devices, except formal fixed tents above shop facades. Second, the incompatible new community, which uses the street path, adds several types of informal shading devices, such as textile shading elements, metal corrugated sheets and umbrellas. This type of community consists of street vendors and the owners of other shops.

The view of the buildings surrounding the path in this area is very crowded, and the informal shading devices

Fig. 11 Zone A—the small node making up the entrance of the studied area

Fig. 12 Zone B—the area of gold markets, based on constructed roofs

Fig. 13 Zone C—commercial path with informal shading devices

Fig. 14 Zone C—the node forming an open space

Fig. 15 Zone D—from left to right: path outside, entrance and Khan Al-Khayyateen inner path

totally block the view of the surrounding context, creating a very deformed view overall, as shown in Fig. 13.

At the end of Zone C, there is a node forming a sort of open space. This node also has commercial activities. The existing shading devices are the same as on the path in Zone C. Due to the scale of the space, the view of the surrounding buildings is far better, but the shaded elements produce an informality and disturbance of the context perception. Figure 14 shows the node in Zone C.

Zone D is the area of Khan Al-Khayyateen; this area consists of two parts. The first comprises the area in front of Khan Al-Khayyateen, which is similar to the path of Zone C. The second is Khan Al-Khayyateen path. The Khan path consists of a semi-shaded constructed path. The community of this path is the original community, which encompasses sewing crafts and a traditional clothes market. Some informal fixed tents have been added inside the Khan. The view of the context inside the Khan is actually good because of the constructed semi-shaded path, but the other shading devices cause small disturbances of the context perception, as shown in Fig. 15.

6 Conclusion

The community is among the main factors that influence the perception of the urban context. The variations in community classifications located in the case study zones result in the generation of different types of shading device, which affect the perception of the urban context.

The deformation of the historical urban morphology directly affects the changes in social activities, which adapt to the urban environment in order to fulfil the new needs of the communities located there.

Understanding the morphological changes in the urban context can explain alterations in the perception of urban building changes. Urban planning deformation, building additions and community originality exchange form the trinity of historical context perception. Thus, any change in one of these factors would affect the morphology of the urban context.

Furthermore, the urban fabric is not the only factor affecting the users' social activity needs. In this case study,

the new building heights, which have an effect on the shading of the urban space, are not sufficient to enhance the microclimate of the narrow historical paths, leading to the emergence of several types of shading device to provide thermal comfort for users.

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Upgrading Local Laws for the Conservation of Heritage in the Light of International Charters and Conventions

Mohamed Helmy Elhefnawy and Aml Abd El-Wareth Mohamed

Abstract

There is a great interest of the Arab and international governments and countries in the process of conservation of the architectural heritage. This heritage has great historical and cultural value for current and future generations. Therefore, many international agencies and organizations have developed a number of international charters and conventions, also many countries and governments, including Egypt, to put in place many laws and regulations that govern the conservation process on the architectural heritage and regulate its management processes. The purpose of this paper is to propose a specific mechanism to develop local laws and legislations, maximize their benefit, expand their implementation and identify deficiencies in local laws and legislations in Egypt, in the light of the principles contained in international charters and conventions related to the conservation of the heritage, that arise because of the lack of clarity the links between the local laws and international charters and conventions and lack of determining how to rely on these charters in the development of local laws. The paper follows the theoretical, descriptive, analytical method, by studying a theoretical background on the concepts international charters and local laws and their role in the conservation process on the architectural heritage; also studying the relationship between them, then identification of deficiencies in the local laws and make proposals for upgrading and development mechanisms in the light of international charters; reaching to the most important conclusions and recommendations, which specify the most important local laws to be promulgated and the most important items of laws to be added to existing local laws.

Keywords

Local laws regulating the conservation process • International charters for conservation • Conservation of the architectural heritage

1 Introduction

The process of conservation of the architectural heritage—whether physical, intangible or natural and cultural assets, and including movable and immovable assets inherited from the past and transferred to future generations—is linked to two important factors: first: physical: this includes all the interventions of the same conservation processes, including continuous restoration, maintenance, protection and documentation. Second: legal: this relates to the issue and development of legal legislation governing these interventions, and to identify the required steps to implement and follow up the implementation of these laws to ensure safety of the archaeological and historical sites and to prevent action against them and not to damage or distort them (El-Borombaly 2015), (https://civilizationlovers.wordpress.com/).

The issue of legislation and laws for conservation of the architectural heritage is the starting point for the protection of heritage buildings and areas, whether on the local or international level, which guarantee the success of any intervention related to conservation. Without effective laws and legislation, that heritage cannot be conserved (Sultan 2013). Therefore, many international agencies and organizations have developed a number of international charters and conventions related to heritage, and many countries and governments, including Egypt, have passed many laws and

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regulations that govern conservation of the architectural heritage and support national policies for protection of heritage (http://www.icomos.org/).

The problem arises in the presence of many aspects of the lack of implementation of local laws and legislations in their current form and failure to achieve their desired role in organizing conservation processes on heritage buildings in Egypt. There is a lack of clarity in the relation between local laws and the international charters and conventions, and a the lack of determining how to rely on these charters in the development of local laws, to reach for ease of application and then achieve conservation. In a way that shows the importance of establishing a specific mechanism to improve local laws and legislation and maximize their benefit from them and expand on their application and identify deficiencies in local laws and legislation, based on the principles contained in international charters and conventions which related to the conservation of heritage.

To achieve this objective, this paper will study concepts related to local laws, legislation, international charters and their role in the process of conservation of the architectural heritage and then the relationship between them. Finally, it will identify deficiencies in local laws reaching to offer a vision of the mechanisms of law development and upgrading in the light of international charters and conventions.

2 A Theoretical Background on International Charters and Local Laws and Their Roles in Conservation of the Architectural Heritage

Legislation related to the conservation of the architectural heritage includes two basic types, international and local. First: international type: this includes all international charters and conventions that can benefit all countries and stipulates that archaeological sites are cultural property and cultural heritage that requires protection and conservation in various ways. Second: local type: this covers all legislations and laws relating to the protection of cultural property and historic sites at the local level, which are based on international and regional conventions, as well as on the local legal reference in conservation of field (https://civilizationlovers.wordpress.com/).

2.1 Concepts of International Charters and Conventions for Conservation of the Architectural Heritage

International Charters of Monuments Conservation are defined as a set of international standards and basics of a technical nature that define the general frameworks for dealing with monuments and heritage for conservation from change and extinction. Despite the diversity of international charters, the main aim of all these is to protect the architectural heritage, keep pace with innovations and limit the deficiencies of this protection, as well as in determining policies and setting appropriate standards, methods and techniques of conservation (http://fac.ksu.edu.sa/).

The texts of the charters and conventions are only morally and professionally bound, and they do not have the force of law. They are close to the laws, but they differ from them in that their implementation is considered an honorable literary matter (Dawud 2008). International charters and conventions for the protection of architectural heritage are formulated in the form of a set of principles, which have two fundamental characteristics (Sultan 2013):

(A) It is a wide range of values and priorities related to the social, cultural and economic life associated with conservation of the architectural heritage.

(B) It came in its entirety to ensure the necessary intervention to protect the physical, historical and aesthetic character and integrity of the architectural heritage of the international and local levels.

2.2 Roles of the International Charters and Conventions in Conservation of the Architectural Heritage

The roles of charters and conventions vary in the conservation process according to the time period during which they were carried out, and according to the main objective of each charter and the agency or organization that issued them. International conventions for the protection of monuments began to appear for the first time in the decisions of 6th International Congress of Architects held in Madrid in 1904; this was followed by many scientific studies and practical efforts of many agencies, including ICOMOS and UNESCO, starting in 1956, in a way that led to the issuance of many charters (Dawud 2008).

The main group of international charters consists of twenty-one charters covering various types of conservation of the heritage, from historical artifacts to historical buildings, urban areas and cities. Each of these charters has its components, objectives, interests and role in the conservation process, as shown below.

1. "**The decisions of 6th International Congress of Architects, 1904**," Madrid, which is composed of six articles deal with the first legalization and organization

of archaeological protection. It focuses on the definition of living monuments (those which continue to serve the purposes for which they were originally intended) and dead monuments (those belonging to a past civilization or serving obsolete purposes), and the Congress proposes to establish an organization in each country for conservation of the monuments. It also stressed on the importance of finding a suitable functional use for a historical building rather than preserving it as a monument.

2. "**The First Athens Charter for the Restoration of Historic Monuments, 1931**," which consists of seven articles drawn up after the destruction of heritage areas during the First World War. It was interested in defining the basic principles for conservation and protection of historic buildings and archaeological areas. It stressed the importance of removing the restoration and replacing it with continuous maintenance. It stressed the need to conduct accurate analytical studies before the implementation of maintenance procedures for buildings and monuments, the need for cooperation and exchange of experiences among countries in the protection of archaeological and architectural heritage, and raising public awareness of importance of conservation of the heritage. The principles of the charter contributed to the establishment of many international institutions such as UNESCO, ICOM and ICOMOS. The whole charter came to express the real beginning to develop the concept of conservation in the international community (Emad 2016).
3. "**The Second Athens Charter (The Historical Heritage of Cities) 1933**," a six-article supplement to the First Athens Charter to fill the shortage of protection of the city's archaeological heritage. This charter was produced as a result of the IV International Congress of Modern Architecture which took as its theme "the functional city" and focused on urbanism and the importance of planning in urban development schemes. Also, it focused on protecting heritage dwellings and other community buildings, and contained serious principles, such as protection of what should be respected only and allow the demolition of some of the duplicate monuments, and the possibility of modification of the parts of the unimportant (monuments), but an important principle calls for protection of the aesthetic elements of the monument of falsehood.
4. "**The International Venice Charter, for the Conservation and Restoration of Monuments and Sites, 1964**," which consists of 16 articles, is the main reference to restoration and maintenance processes (Sultan 2013), focuses on non-construction, demolition or alteration of existing monuments and their surrounding environment. It stresses the importance of use of periodic maintenance means and the necessity to respect the old materials and original documents and stop the restoration when the conjecture begins, with the need to distinguish new additions and ban all reconstruction works. The importance of conservation of archaeological sites, preserving and showing the aesthetic and historical values of the monuments, not allowing to the construction of a new building, leads to change and distortion of the visual relationship in shape or color (http://fac.ksu.edu.sa/). It also allowed the use of the building in a new use to benefit the community, provided that it does not affect or change the distribution of spaces or in the form of the building, with the necessity to conserve the conditions of the surrounding environment.
5. "**Burra Charter, 1979**," issued by the Australia ICOMOS Charter for Places of Cultural Significance, which consists of 34 articles, focuses on the development of the principles of the Venice Charter to suit Australian local needs and focuses on role of community participation in conservation. Support conservation and management of the place with the participation of people, who have links with the building or other social, spiritual or cultural subordination to the place. The charter was revised in 1999 and has since been adopted by the Australian Heritage Council.
6. "**Lahore Charter, International Symposium on Conservation and Restoration of Islamic Architectural Heritage, 1980**," consisting of 19 articles in conformity with the articles of the Venice Charter, adapted to the specificity of Islamic architecture. It is issued by UNESCO. It also recommends the reversibility principle, where it is recommended to use techniques that can be reversed and return the monument to its original condition before restoration.
7. "**Florence Charter for Historic Gardens, 1982**," which consists of 25 articles, dealing with the protection, restoration, conservation and restoration of heritage gardens and their living botanical components. It was endorsed by the International Commission of Historic Gardens of ICOMOS in Florence in May 1981 and registered with the Economic and Social Commission for Asia and the Pacific in December 1982 as an addition to the Venice Charter. The historical garden has been defined and its architectural components and how to conserve on them.
8. "**Appleton Charter, for Protection and Enhancement of the Built Environment, 1983**," which consists of four items, is a major qualitative shift in the direction and style of protection. It deals with monuments, in a new concept, as a source of wealth. It is interested in introducing the concept of heritage management and community participation. It also addresses the levels of

intervention in conservation policies to keep on the urban heritage, including the existing form, materials, place unit, restoration, rehabilitation, construction and development in accordance with cultural importance, state and safety of the building, value, appropriate use of available physical, social and economic resources. It also takes care of the need to develop periodic interventions to stop deterioration of the interventions of maintenance, installation, removal, addition, stabilization, with minimal change.

9. "**Washington Charter, for Conservation of Historic Towns and Urban Areas, 1987**," which consists of 16 articles, was adopted based on the principles of the Venice Charter and aims to limit the impact of the re-planning projects and urban development on monuments that are a threat to them. The charter is concerned with the protection of large and small historic urban areas and conservation of historical cities and neighborhoods threatened by damage due to the type of urban planning which is created by industrial and social development, or the deterioration resulting from the abandonment of cities and historic neighborhoods to modern urban cities. It works for conservation of the historical characteristics of these cities, and conservation on the relationship between the city and its natural surroundings (http://fac.ksu.edu.sa/).
10. "**International Lausanne Charter, for the Protection and Management of Archaeological Heritage, 1990**," which consists of nine articles, defines the basics of management and organization of the archaeological heritage, where it explains the responsibilities of both public and legislative agencies, also the performance and rehabilitation of technicians and workers in the field of monument protection, and stresses the need to carry out the necessary studies to clarify the impact of urban development projects before implementation. It is one of the most important international charters that have systematically and scientifically contributed to the management of archaeological heritage, and the establishment of the basics and rules of its administration, which can be applied in all archaeological sites in the world (http://fac.ksu.edu.sa/).
11. "**Sofia Charter, for the Protection and Management of Underwater Cultural Heritage, 1996**," established this charter to achieve and promote the protection and management of submerged monuments, and emphasize that their study and visit necessitate special equipment and techniques not available to the majority, creating a large barrier between these monuments and the public.
12. "**ICOMOS Charter, Principles for the Preservation of Historic Timber Structures, 1999**." Consisting of 15 items, it aims to define basic and universally applicable principles and practices of preservation of historic timber structures, whether constructed of timber in whole or in part and of cultural significance or constituting parts of a historical area, and focuses on taking into account their diversity, and in the procedures and treatments needed for conservation of these heritage resources for changing environmental and climatic conditions, fires and disasters (ICOMOS Charter 1999).
13. "**Mexico I Charter, International Cultural Tourism Charter Managing Tourism at Places of Heritage Significance, 1999**." It focuses on promoting conservation of the heritage and the tourism industry, determining the relationship between heritage and dynamic tourism and resolving the conflict between them. Also, it focuses on the importance of managing the conservation process in a sustainable manner for present and future generations, with attention to tourism planning of architectural heritage to ensure that heritage sites are a pleasant and enjoyable experience for visitors (Mexico I Charter 1999).
14. "**Mexico II, Charter on the Built Vernacular Heritage, 2000**." It focuses on issues and principles related to the conservation of the public heritage of the building —traditional and natural community housing—which has become very weak in the context of globalization. It also sets guidelines for conservation practices on the traditional crafts and skill building, adaptive reuse, and training for conservatives and local communities (Mexico II Charter 2000).
15. "**Zimbabwe Charter, Principles for the Analysis, Conservation and Structural Restoration of Architectural Heritage, 2003**," consists of three items. It outlines the basic concepts of conservation, adopted in the ICOMOS document, which must be followed by the designer. It is based on a concept of safety assessment of the building, as a basic step in the diagnosis of the situation, and to determine the need for its treatment measures. It focuses on the need to reconcile qualitative and quantitative analysis, based on direct observation and historical research and structural analysis, as well as tests before making any decision on structural intervention, to determine the causes of damage and disintegration first and then the assess level of the integrity of the structure. While emphasizing that no action is taken without ascertaining the potential benefits to the architectural heritage, except in cases where urgent preventive measures are necessary to avoid imminent collapse of the structures (Zimbabwe Charter 2003).
16. "**Zimbabwe Charter, Principles for the Preservation and Conservation-Restoration of Wall Paintings, 2003**." Consisting of ten articles, it focuses on

maintaining wall paintings as an integral part of the monuments and sites, which should be preserved in site. It focuses on eliminating the problems that affect the improper use of these paintings, lack of maintenance, frequent repairs and alterations that harm them, and identifies appropriate methods and materials that do not lead to irreparable harm (Zimbabwe Charter 2003).

17. "**The Saudi Charter for Conservation and Development of Urban Heritage in the Arab Countries, 2003**," which consists of 28 articles, focuses on the importance of community participation through civil society institutions and the importance of public awareness and develops policies to raise awareness of the importance of the urban heritage aimed at all those concerned with heritage and different levels of education and various decision-makers at the national and local levels.
18. "**International Charter for Archaeological Heritage Management, 2009**," focuses on monument restoration projects, emphasizes that the living traditions of the local population are an important component of the archaeological heritage of these sites and monuments and emphasizes that participation of local cultural groups is necessary for the protection and conservation of the heritage and stresses the importance of cooperation between the various parties involved in conservation, including ordinary members of society (Khadrawi 2013).
19. "**Dublin Charter, the TICCIH Principles, for Conservation of Industrial Heritage Sites, Structures, Areas and Landscapes, 2011**." Issued by the International Council TICCIH, ICOMOS, which consists of 14 items, it focuses on documentation, protection, preservation, understanding and appreciation of the industrial heritage and its associated buildings, sites, traditional industrial areas, landscapes and values, and ensuring effective protection and conservation. As well as issues and threats that affect on it as a result of its relationship with contemporary economic, legal, cultural and environmental conditions. As part of the human society's heritage all over the world, and is the first international reference text to guide protection and conservation in this field. It includes both movable and immovable physical assets, the complex social and cultural legacy that shaped the lives of communities, and the most significant organizational changes to entire communities and the world in general.
20. "**Valletta Principles for the Safeguarding and Management of Historic Cities, Towns and Urban Areas, 2011**," which consists of four items. It proposes applicable principles and strategies to all interventions in historical cities and urban areas. It works to protect the values of historical cities and surroundings of it as well as their integration into contemporary social, cultural and economic life (The Valletta Principles 2011).
21. "**Burra Charter, the Australia ICOMOS Charter for Places of Cultural Significance, 2013**," which consists of 34 articles, was first adopted in 1979 in the historical city of Burra, South Australia. Minor revisions were made in 1981 and 1988, with substantial changes in 1999. Following the audit, the 1988 guidelines were omitted and were finally adopted by ICOMOS in 2013. Burra Charter provides guidance for the conservation and management of places of cultural significance and is based on the knowledge and experience of the members of the Australia ICOMOS. It consists of conservation definitions, principles, processes and practices. It can be applied to all types of places of cultural significance, including natural and historical places with cultural values (Burra Charter 2013).

In addition, many international conventions have been issued on the conservation of the architectural heritage, as follows:

1. "**Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict**," including its first protocol of 1954, consisting of 21 articles, and second protocol of 1999, consisting of 47 articles, the convention was adopted by UNESCO during the First and Second World Wars and recommended the adoption of all international and national measures for the prevention, respect and continuous protection of movable property and archaeological sites such as buildings, archaeological sites and cultural property such as manuscripts, books and all objects of historical and archaeological value to countries in times of peace and war, and not subject to destruction or damage, looting or squandering as a cultural and human heritage. As well as respect for buildings dedicated to the protection of cultural property itself, such as museums, bookstores, and archives (Hague Convention 1954).
2. "**Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property, 1970**," adopted by the Sixteenth Congress of UNESCO. As transfer is one of the main reasons for the impoverishment of the national cultural heritage in the original home of heritage, and stressed on the need for countries to put in place the appropriate measures for the return of cultural property by diplomatic means, and the imposition of administrative sanctions and penalties on those who violate these laws, and on countries whose cultural property is being looted, should use other countries to adopt measures to

control exports, imports and international trade in cultural property, the International Institute for the Unification of Private Law also recommended that stolen or illicitly exported cultural objects in Rome be returned in 1995 to their origin countries (Convention 1970).

3. "**Convention for the Protection of the World Cultural and Natural Heritage, 1972**," which consists of 38 articles (http://whc.unesco.org/). It focuses on the importance of using education curricula and informing the public about threats to natural and cultural heritage. The convention seeks to protect the threatened heritage of the world from destruction by human and natural activities. The convention also gives each country the right to determine the sites within its territory that need to be preserved and then provide for future generations, as it is a global heritage. It also provides the right to the cooperation of the international community and helps with conservation on national heritage by listing the sites in the Global Heritage List (http://www.icomos.org/). The convention was adopted by the General Conference of UNESCO on the basis of the decision taken at the United Nations Conference on the Human Environment in Stockholm.
4. "**Convention for the Protection of the Underwater Cultural Heritage, Paris, 2001**," which consists of 35 articles, was adopted by the General Conference of UNESCO and focused on enabling countries to protect their underwater heritage and better promote their research (www.unesco.org). It also emphasizes that heritage is at risk, from looting and commercial exploitation. Thus, legal protection is insufficient in some countries, some of which permit the possibility of selling those artifacts resulting from prospecting for underwater monuments, as well as the possibility of increasing access to flooded sites.
5. "**Convention for the Protection and Safeguarding of the Intangible Cultural Heritage, Paris, 2003**," which consists of 40 articles. It aims at preserving and promoting the importance of this heritage at the local, national and international levels through international cooperation and assistance (http://www.alecso.org/). The convention has broadened the scope of the international discourse on the definition and meaning of cultural heritage and the concept of intangible cultural heritage. The convention provided a number of important concepts relating to intangible cultural heritage. The theory is that culture is alive and evolving so that artifacts pass from generation to generation, and the concept of conservation as measures to ensure the continuity of intangible cultural heritage (https://ich.unesco.org/).
6. "**Convention on the Protection and Promotion of the Diversity of Cultural Expressions, 2005**," which consists of 35 articles. It is issued by UNESCO and emphasizes the importance of increasing public awareness through educational and training programs, and cooperation with international and regional organizations to achieve this goal and to promote productive capacities, through the establishment of education and training programs in the field of cultural industries, without affecting on traditional forms of production. The aim is to conserve cultural properties, prevent illicit trafficking and limit robberies, theft processes and the deliberate transfer of such property beyond the borders of the original countries (https://civilizationlovers.wordpress.com/).

2.3 Concepts of the Local Laws for Conservation of the Architectural Heritage

Countries and governments are directly responsible for conservation of their architectural heritage and therefore seek to put laws, legislations and local policies which to do that (Sultan 2013).

The law can be defined as a set of binding principles and general rules that govern the behavior of members of society and organize it. The law establishes the rules that determine the rights and duties of individuals, and sets the appropriate penalties in case of violation of these rules and foundations. Legal rules are constantly changing, depending on developments and changes in society. The law is more comprehensive than legislation and is issued by judicial decisions, and legislation is passed by the legislature (http://mawdoo3.com/). Therefore, most countries have enacted their own laws that are parallel to international conventions and rely on them in technical matters to ensure that their monuments are safeguarded (Dawud 2008). And the violation of the penalty expected by the public authority (Dawud 2008).

Local conservation laws are laws and regulations that each country sets in order to conserve its architectural heritage and to impose deterrent penalties in case of violation. This is done in accordance with local needs by reference to the international conventions in the field of conservation and guidance (https://www.facebook.com).

2.4 Roles of Local Laws on Conservation of the Architectural Heritage

The Egyptian government legislated a number of local laws and executive regulations to the conservation of the architectural heritage, each with its role and importance, as shown below:

1. **Law No. 177 of 1983**

The law was issued in 1983 and claims "**the Antiquities Protection Law**." It was updated and issued in 2010, which consists of 4 sections and 51 articles. The law was the only one responsible for the protection of antiquities until the promulgation of Law No. 144 of 2006 and its executive regulations. It focuses on conservation of the highly transferred heritage such as the artifacts produced by different cultures, the arts, science, the literature or religion by a certain historical era or successive historical periods, even a hundred years ago, but provided that these pieces express importance and are considered one of the manifestations of different cultures (Egyptian Law No. 177 of 1983).

2. **Law No. 144 of 2006**

This law is concerned with "**On the Regulation of the Demolition of Unthreatened Buildings and Constructions and the Conservation of the Architectural Heritage**," which is not covered by Law No. 117, which consists of 17 articles.

And includes the considerations of dealing with buildings and constructions with distinctive architectural styles associated with national history or historical figure or which is a tourist attraction, as well as to determine the procedures followed on the demolition of these buildings and stresses the need to do so only with a license issued in accordance with the provisions of this law. The law focuses on the establishment of a standing committee in each governorate to limit the buildings and constructions with distinctive architectural style (Egyptian Law No. 144 of 2006).

3. **Law No. 119 of 2008**

This law is called the "**Building Law**"; it consists of 6 parts and deals with urban planning, urban coordination, organization of construction work and conservation of the real estate wealth. It is responsible for conservation of the most characteristic areas of architectural and urban value as well as buildings and other natural elements.

This law includes areas that are rich in architectural, physical, symbolic, aesthetic heritage or natural value; they need to be treated as an integrated unit to be conserved.

This law differs from the other laws in its field of application. The law covers urban areas in general and not buildings in themselves. This law defines these areas and the boundaries of their buffer zones. This law serves as a supplementary law in order to conserve the urban context in an integrated manner (Egyptian Law No. 119 of 2008).

With reference to the issue of the guideline for the basics and standards of urban coordination of heritage buildings and areas in 2009 approved by the Supreme Council for Planning and Urban Development, which was issued in accordance with Law No. 119. This guideline aims to develop a methodology for monitoring, recording and documenting heritage buildings and areas. And to determine the methods of dealing with them depending on the value and condition of each building and the characteristics of its urban environment. As well as identifying methods of dealing with neighborhoods, areas and heritage gardens in conservation, development and upgrading projects (Foundations and standards 2009).

3 The Reciprocal Relationship Between International Charters and Local Laws Related to the Conservation of the Architectural Heritage

The relationship between international charters and the relationship of these international charters to local laws will be determined below.

3.1 Determine the Relationship Between International Charters and Conventions for Conservation of the Different Architectural Heritages

There is an interrelationship between international charters and conventions. There are charters that are complementary to others and other charters which came to amend previous charters. There are charters that come together to achieve a certain objective of conservation process objectives, and other time-bound, to clarify the relationship and similarities between the various international conventions. Different categories of international charters and conventions related to the conservation of the architectural heritage will be presented.

3.1.1 Classification of International Charters and Conventions in Accordance with Conservation Objectives

The objectives of the architectural conservation process were conceptualized and linked to the emergence and adoption of various international charters to include **six basic objectives** of the charters (Sultan 2013):

First: **international charters related to the purpose of protecting heritage buildings**: the international community at the beginning of the trend for the conservation process to establish the initial basis for the protection and promotion of conservation of the monuments. It has appeared in several charters, supporting this, including: the decisions of 6th

International Congress of Architects in Madrid in 1904, the Second Athens Charter of 1933 and Hague Convention 1954.

Second: **international charters related to the purpose of organizing the dealing with heritage**: The international charters and conventions came after the Charter of Athens to regulate how to deal with urban heritage and the most important supporting charters for this Venice Charter 1964.

Third: **the international charters related to the purpose of covering the heritage sites**: these are compatible with the international trend toward the need to take care of the comprehensive historical and heritage sites in conservation and not only the monuments as separate buildings, in addition to the open areas which contain archaeological and excavation sites that represent human settlements, Burra Charter 1979, Lahore Charter 1980, Florence Charter 1982, Sofia Charter 1996 and Dublin Charter 2011.

Fourth: **international charters associated with the goal of small urban stability**: the expansion of international attention to urban heritage to include small urban settlements and cities. This was in Washington Charter 1987, Mexico II Charter 2000.

Fifth: **international charters related to the purpose of conservation and restoration**: it came to recognize the importance of conservation, restoration and maintenance of heritage sites in ways and methods to be followed, including the Appleton Charter 1983, International Charter 1999 and Zimbabwe Charters 2003.

Sixth: **international conventions related to the purpose of heritage management**: it is in line with the goal of heritage management and community participation, notably Lausanne Charter 1990, Mexico I Charter 1999, the Saudi Charter 2003, International Charter 2009, Valetta Principles 2011 and Burra Charter 2013.

3.1.2 Classification of International Charters and Conventions According to the Nature of Architectural Intervention to Achieve Conservation

The international charters were divided according to this classification into three generations, including the following (Dawud 2008):

First: **charters focused on technical and operational matters according to their theoretical and intellectual basis.** In particular, it has focused on creating the means of material conservation of the monument and includes the first four charters: 6th International Congress of Architects, Madrid, 19; the First Athens Charter 1931; the Second Athens Charter 1933; Venice Charter 1964; and Lahore Charter 1980.

Second: **charters focused on administrative organizations.** Their main concern is to emphasize the concepts and administrative regulations for the protection of monuments, rather than their technical and operational concerns. They have been formulated based on the definition of conservation objectives and principles rather than on specification and include Washington Charter 1987, Lausanne Charter 1990, Mexico Charter and the Charter of the United States of America 1999.

Third: **the charters focus on technical and executive matters and administrative organizations together**: these are interested in the status of specialization in a particular archaeological field or in the building material of a specific archaeology and are characterized by the formulation of combining the method of drafting the first and second groups, where the intention is identify the objectives and at the same time to determine the details of the techniques and operational requirements, and includes Florence Charter 1982, Sofia Charter 1996, ICOMOS Charter 1999, Mexico II Charter 2000, Zimbabwe Charter 2003.

3.2 Relationship Between Local Laws for Conservation of the Local Architectural Heritage

The three local laws in Egypt are complementary to each other. Each law is concerned with covering a certain aspect of conservation of the architectural heritage; the difference between them is evident in the level of conservation (attention to fixed and movable monuments only or interest in buildings only or attention to areas in general), as well as in proposing new definitions of some terms associated with conservation operations, and finally appears in the focus on the establishment of committees or agencies competent to oversee conservation processes.

3.3 The Relationship Between International Charters and Local Laws Relating to the Conservation of the Architectural Heritage

The relationship between international charters and conventions and local laws needs to be examined in order to study the basic concerns of each of these charters, to identify the relevant local laws and thus to clarify the relevance of each charter to one of the existing relevant local laws, as shown in Table 1.

Table 1 Identify Egyptian local laws related to the international charters and conventions from the perspective of their main concerns

		International charters and conventions concerned with conservation	Basic concerns within international conventions and conventions	Identification of relevant local laws
International charters	1	6th International Congress of Architects 1904	– Definition of living and dead monuments – The importance of finding suitable functional use of the historical building	Law No. 177 of 1983 Law No. 144 of 2006
	2	The First Athens Charter, 1931	– Proposing basic principles for conservation and protection of historical buildings – Identification of methods and ways of restoration	Law No. 177 of 1983 Law No. 119 of 2008
	3	The Second Athens Charter, 1933	– Attention to the protection of heritage dwelling and other community buildings. – Focus on for protection of the aesthetic elements of the monument of falsehood	Law No. 119 of 2008
	4	Venice Charter, 1964	– Emphasize not to build or destroy, or mutation of the existing monuments and the surrounding of it – Emphasis on the importance of periodic maintenance, and the use of the building in a new use benefiting the community	Law No. 119 of 2008
	5	Burra Charter, 1979	– Maximizing role of the community participation – Emphasize the necessity of the appropriate local needs of conservation	Law No. 119 of 2008
	6	Lahore Charter, 1980	Emphasis on the use of techniques that can be reversed and can return the monument of its original state before restoration	Law No. 144 of 2006 Law No. 119 of 2008
	7	Florence Charter, 1982	Take into account the specificity of the protection, restoration, conservation and reconstruction of archaeological gardens	–
	8	Appleton Charter, 1983	– Considering the monuments as a source of wealth – The importance of appropriate use of available physical, social and economic resources	Law No. 119 of 2008
	9	Washington Charter, 1987	– The necessity of conservation of the historical cities and neighbourhoods associated with industrial and social heritage	Law No. 119 of 2008
	10	International Lausanne Charter, 1990	– Emphasize the management and organization of archaeological heritage – Identify the responsibilities of both public and legislative agencies	Law No. 177 of 1983 Law No. 144 of 2006 Law No. 119 of 2008
	11	Sofia Charter, 1996	Achieve and promote the protection and management of submerged monuments	–
	12	ICOMOS Charter 1999	– Emphasize the need to protect and preserve historic buildings and wooden parts	–
	13	Mexico I, 1999	– Determine the relationship between heritage and tourism – Tourist planning for heritage	–
	14	Mexico II, 2000	– Emphasis on maintaining local architecture	–
	15	Zimbabwe Charter, 2003	– Proposing basic concepts and guidelines for conservation – Assess safety assessment as a key step in identifying interventions	–

(continued)

Table 1 (continued)

		International charters and conventions concerned with conservation	Basic concerns within international conventions and conventions	Identification of relevant local laws
		Zimbabwe Charter, 2003	– Determining the principles of conservation and restoration of paints and murals	Law No. 177 of 1983 Law No. 144 of 2006
	17	The Saudi Charter, 2003	– Emphasize the importance of community participation – Proposing policies to raise awareness of the importance of heritage	Law No. 119 of 2008
	18	International Charter for Archeological Heritage Management, 2009	– Maximize the importance of participation of local cultural groups in conservation – The necessity of protecting archaeological heritage sites	Law No. 177 of 1983 Law No. 119 of 2008
	19	Dublin Charter, 2011	– The necessity of preserving the sites, structures, complexes, areas and landscapes of industrial heritage	–
	20	Valletta Charters, 2011	– Emphasis on the necessity of protecting historical cities and urban areas	Law No. 119 of 2008
	21	Burra Charter, 2013	Proposing definitions, principles, processes and conservation practices	Law No. 119 of 2008
International conventions	1	Hague Convention, 1954	Emphasize the necessity of protecting cultural property in case of armed conflict	–
	2	Convention, 1970	– Proposing means of preventing and prohibiting the illegal import and transfer of ownership of cultural property	Law No. 177 of 1983
	3	Convention, 1972	– The importance of using education curricula and informing the public about threats to heritage	Law No. 119 of 2008
	4	Convention, 2001	– The necessity of protecting underwater cultural heritage from danger, looting and commercial exploitation	–
	5	Convention, 2003	Emphasize the importance of protecting and safeguarding the intangible cultural heritage	–
	6	Convention, 2005	– The necessity of increasing public awareness	–

The table shows the common interest between some international conventions and one or more of the local laws, as well as the existence of some charters, that are not mentioned in any of the local laws, related to the international charters and conventions that were issued at the time. The table also shows the existence of some of the charters issued after the issue of the last local law in 2008 has been linked to the nearest local law related to it to study the deficiencies of the law and take into account when developing it.

3.4 Deficiencies of Local Laws to Conservation from Their Relevance to International Charters

The existence of three local laws, specialized to conserve the architectural heritage, is insufficient to cover all the concerns of international charters and conventions and the materials and items in them and thus has let to the emergence of some deficiencies in these local laws, as follows:

1. Lack of specialized laws in a certain field in conservation of the architectural heritage, where there are some international charters and conventions that have not covered any of its interests in any of the three local laws, where each of them has objectives and interests far from the concerns of these conventions, for example, specialized laws in conservation of all the sunken monuments in the coastal areas such as Alexandria, archaeological gardens, wood installations, heritage industrial facilities.
2. Lack of emphasis on some items and articles of international conventions within the three local conservation laws, where some items were ignored in all local laws despite their participation in the goal, for example, the

existence of items focusing on the archaeological awareness of citizens; the importance of the existence of school and university decisions on the importance of conservation of monuments; the concept of community participation, ways of managing heritage areas; how to develop a conservation plan; how to take advantage of modern architectural trends such as green architecture, sustainability and others in conservation of the buildings and areas of heritage; how to protect heritage buildings from demolition in the event of disasters and wars; the role of the agencies and organizations, both **international** involved in international organizations such as the Aga Khan, UNESCO, and **local** as the country and the private sector as businessmen to ensure continuity in funding and not to damage heritage buildings and areas.

3. Lack of governing laws and regulations in the process of conserving on the heritage, as a result of the lack of local interest in the development of legislation compatible with the provisions of international conventions and charters, is as follows:
   - The absence of legislation and laws related to the organization of buildings in heritage areas to conserve on the architectural heritage (Khadrawi 2013).
   - The absence of specific policies to deal with traditional housing and neighborhoods and the surrounding areas or the reconstruction of dilapidated urban heritage buildings.
   - The absence of laws to determine the responsibility of the country and related parties and individuals, considering that most of the heritage buildings in the heritage areas are private property.
     This is also reflected in the non-activation of certain articles supplemented by some laws, as follows:
   - Non-activation of articles for theft, looting and demolition of heritage buildings in the form of deterrent to offenders and to ensure compliance with those laws due to some gaps.
   - Lack of clarification of sources of funding for the restoration and conservation of monuments and heritage buildings and how to re-employ them using B. O.T and other re-employment methods.
   - The absence of supplementary laws to clarify the mechanism of work of the committees of the inventory of monuments in each governorate issued by Law No. 144 of 2006.
   - Lack of clarification of the agencies and advisory offices responsible for the implementation of restoration works and conservation and how to work.

4 Mechanisms for Upgrading Local Laws for the Conservation of the Architectural Heritage in the Light of International Charters

The development of local laws for the conservation of the architectural heritage, in accordance with the provisions of international charters and conventions, depends on a set of steps and procedures to be followed in order to be fully upgraded through two basic steps. **First** is the precise identification of deficiencies in the local laws and the statement of the items that have been neglected and needed to be added within the three existing laws, conventions or items that have not been dealt with at any of the local laws and needed to be issued a new law of its own. **Second** is related to the interventions and procedures required in each of the three existing local laws through modifications to its own regulations, as well as the identification of the new specialized laws to be developed to cover a certain aspect of the conservation, which is completely ignored by the existing local laws.

4.1 Precise Definition of Deficiencies in Local Laws Compared to Global Conventions and Charters

This is done by the following four main steps:

First: careful study of the important objectives, interests for items within each charter or international convention.
Second: the study of the three local laws and the extent of their coverage of provisions of international covenants.
Third: identifying deficiencies in local laws in terms of international charters and conventions.
Fourth: the internal classification of the deficiencies and determine what is associated with the addition of new laws or what needs to add new items only.

4.2 Steps to Develop Local Laws for the Conservation of the Architectural Heritage

This is done by clarifying items to be added by each of local laws as well as the laws proposed to be enacted according to the following; see Fig. 1:

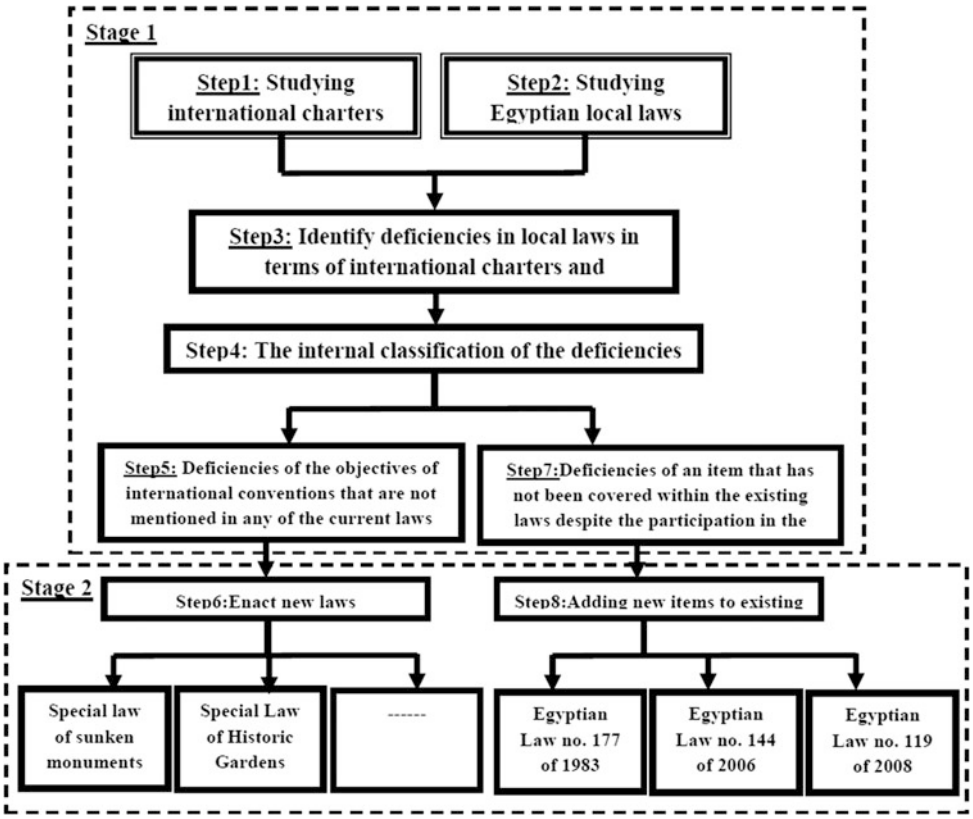

Fig. 1 Mechanisms of upgrading local laws for the conservation of architectural heritage in the light of international charters

With regard to Law No. 177 of 1983, the following items may be added:

- Identification of ways of managing and organizing the archaeological heritage.
- Determining the precise responsibilities of each public organization or legislative participation in the conservation process.
- Determining the appropriate functional use of the historical building.
- To clarify the mechanisms of participation of local cultural groups in conservation.
- Determining principles of conservation and restoration of paints and wall murals.
- Explaining ways to protect archaeological heritage sites.
- Identification of means of preventing and prohibiting the illegal import and transfer of ownership of cultural property.

With regard to Law No. 144 of 2006, the following items may be added:

- Proposing basic principles for maintenance and protection of historical buildings, and linking these to the nature of the building.
- Determining the responsibilities of agencies responsible for the conservation and the basic functions.
- The precise identification of methods and ways of restoration.
- Emphasizing the use of techniques that can be reversed, return to the original state before the restoration, and clarify the mechanisms of this accurately.
- Determining principles for conservation and restoration of paints and murals.

With regard to Law No. 119 of 2008, the following items may be added:

- Explaining the means of architectural protection and conservation of archaeological heritage sites and historical cities and Egyptian urban areas.
- Determining the means of conservation of the historical areas and cities threatened by damage due to industrial and social development.
- Emphasizing not to build or destroy, or mutation of existing monument and its surrounding environment and ways to protect dwelling and other community buildings.
- Focusing on the importance of periodic maintenance and ways to achieve this, and how to use the monument for a new purpose to benefit the community.
- Explaining how to manage and organize the archaeological heritage and identify the responsibilities of both public and legislative agencies.
- Determining how community participation can be activated and how local communities and cultural groups should be accommodated in conservation processes.

- Explaining ways to transform monuments into a source of wealth.
- Developing policies to raise awareness of the importance of the heritage and ways to protect the aesthetic elements of the monument.
- How to use education curricula and inform the public about threats to heritage.
- How to use appropriate available physical, social and economic resources.

With regard to the issue of new laws, the laws and regulations that regulate the following can be enacted:

- Protection and management of submerged monuments and underwater cultural heritage from vulnerability, looting and commercial exploitation.
- Protection and preservation of historic timber installations.
- Preservation of sites, structures, complexes, areas and landscapes of industrial heritage.
- Conservation of the local architecture.
- Protection, restoration, conservation and reconstruction of historic gardens.
- Tourism planning of heritage, with a definition of the relationship between places of heritage and tourism.
- Protection of cultural property in case of armed conflict.
- Protection of the heritage dwellings and other community buildings' age and protection of the aesthetic elements of monument.
- Protection and preservation of intangible cultural heritage.
- Actions to be followed to increase public awareness.
- Sanctions in case of violation to the detriment of heritage buildings.
- Safety assessment as a key step in identifying interventions.

5 General Conclusions and Recommendations

Following are the results of the mechanisms for upgrading local laws of conservation of the architectural heritage, with the main recommendations of the study.

5.1 Conclusions

1. There is a great influence of the international legal and law aspects represented by the international charters and conventions or local laws represented by the three local Egyptian laws on the conservation of architectural heritage.
2. There is a serious lack of commitment to some of the terms and concerns of international charters and conventions when putting local laws.
3. Allowing attention to upgrading local laws to maximize the benefit of all interventions related to the development and upgrading of conservation processes.
4. The local legislative aspect needs to be developed and upgraded, whether by adding some items to existing local laws, or by introducing new laws that cover some of the new aspects of conservation processes that have never been addressed by existing local laws.
5. The mechanism of upgrading local laws from the perspective of international charters is divided into two main stages: **First** is to identify the deficiencies of local laws after careful analysis of terms of international charters and articles by local laws. **Second** includes the full identification of all the articles and items to be added in each local law as well as laws to be developed.
6. Adopting the upgrading of the three local laws on the precise definition of international charters and conventions of common interest and close objectives, see Fig. 2.
7. The upgrading of local legislations requires enacting new laws regulating the protection of sunken monuments, looting and commercial exploitation, historic timber installations, industrial complexes, local architecture, archaeological gardens, tourism planning of heritage, cultural property, intangible cultural heritage, heritage dwelling and other community buildings and protection of the aesthetic elements of the monument of falsehood, as well as the assessment of safety, legal procedures required to increase public awareness and penalties in case of violation to the detriment of heritage buildings.
8. There is a severe lack of interest in the enactment of laws interested in the process of conservation of the heritage where there are only three laws (No. 177 of 1983; No. 144 of 2006; No. 119 of 2008), and all of them need to add new items to cover objectives and items of the relevant international charters.

5.2 Recommendations

The study recommends that:

1. Maximizing the benefit of international charters and conventions to upgrade the current three Egyptian laws by following systematic steps, by compilation and studying of all international charters and conventions, and ensure the benefit of the provisions contained in the formulation and development of Egyptian local laws.
2. Defining deficiencies in local laws in terms of their adherence to the provisions of international charters and

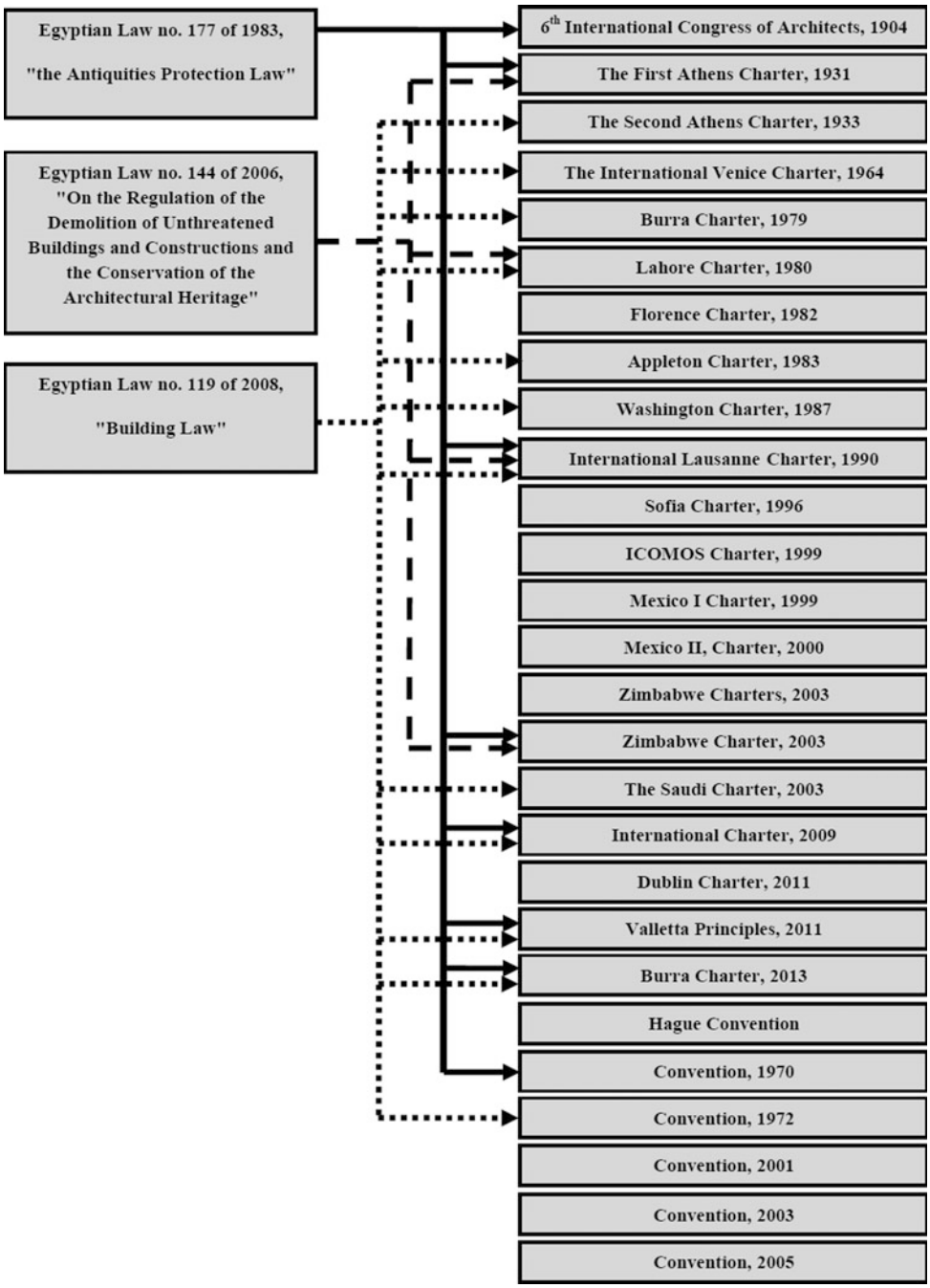

Fig. 2 Egyptian local laws related to international charters and conventions

conventions and putting stable mechanisms for upgrading them.

3. Attention to the enactment of new laws covering principles of international charters that have not been addressed in any of the existing local laws.
4. Filling the gap between the current local laws and the international charters of interest and common objectives by seeking to enact executive regulations for these laws and adding some items that have not been covered efficiently.
5. Proposing legal basics and principles for implementation of conservation processes and directing the competent executive authorities to put them within their plans and programs.
6. Interest in the review of international conventions that were issued after the last local law in 2008 and seek to cover principles stated therein.
7. To take care of the legal, legislative framework within the conservation process and strive toward activating the legislations and implementing them in cooperation

with the security and judicial bodies, while ensuring that the public is aware of collective responsibility.

8. The necessity of a legal legislative framework for the work of construction and change in heritage areas, the purpose of which is not only to control these processes, but also to serve the comprehensive development and conservation of the architectural heritage.
9. The necessity of laws to be flexible in controlling the issue of construction in heritage areas, in terms of giving absolute priority to the accurate repair of the original building, reuse of original building materials wherever possible, the use of modern techniques of consolidation and promotion of the original purpose of real estate, and noting the changes and additions to be made to the building to carry out its new function, taking into account that it conforms to the building itself and with the adjacent perimeter, in terms of size, scale, material and general character of the area.
10. Local laws for the conservation of the architectural heritage must take into account modern architectural trends and existing international charters and address evolving changes to the surrounding cultural, social and economic conditions.

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Part IV
Conservation of Tradition and Identity

The authors of the first chapter in this part, titled "Reflections of Aesthetic Culture Composed by Cultural Memory on the Urban Space," redefine urban aesthetics. They argue that the appearance of a city does not determine whether its urban form is aesthetically pleasing, but its cultural memory is what defines its beauty. According to the authors, cultural memory comes from customs and communication, but it is not identified by them. Given that cultural memory is fading away and it is being forgotten, the authors argue that urban aesthetics are, therefore, under threat.

In Chapter, "Degree of Respect for Authenticity in the House's Restorations of the Medina of Tunis," the authors begin by describing the monuments and heritage sites in the Medina of Tunis. In this chapter, the authors evaluate the degree of respect for the authenticity and the principles of good restoration of the operations, carried out by the three actors intervening in the houses in the Medina of Tunis. The study initially aims to define the general principles, then to evaluate the degree of respect for these principles and authenticity by identifying the characteristics of the restorations of each actor and, finally, to draw general recommendations. Similarly, in the chapter titled, "Preserve the Identity of Traditional Buildings Through Conserving Their Passive Systems," the author also discusses the importance of conserving traditional buildings. In hot and dry climates, traditional buildings needed to respond to the harsh environment and did so by adopting passive systems such as wind catchers that served to ventilate and lower the indoor temperature. This chapter explores the environmental, social, cultural, and historical values of three types of wind catchers in Kuwait: wind towers, wind parapets, and wall openings.

The chapter titled, "Penna Brick Factory at Scicli: A Proposal for a Sustainable Reuse in Sicily," sheds light on the Penna brick factory at Scicli, near Ragusa, which is one of the most singular examples of industrial heritage in Sicily. This chapter outlines the construction history of the building that emphasizes its unique character, and it illustrates the ways to recover and reuse the factory.

On the other hand, Chapter "Architectural and Urban Expression in Nubian Villages Origins and Transformation with Special Reference to Displacement Villages," provides a very interesting review of the urban environment in Nubian villages. The paper considers Nubian Communities as a distinguished manifestation of the reciprocal relationship between people and places and the resulting culture, cultural patterns, architecture, and built environments. In another review of heritage sites in Egypt, the chapter titled, "Evaluation of Applied Treatment Polymer on Egyptian Tura-Ma'sara and Mokattam Monument Limestone," describes the results of a laboratory evaluation carried out on stone consolidants, silica-acid-ester (Wacker-OH), aliphatic-urethane-resin (Z.K.F), acrylate resin (ACR), and polymethyl methacrylate (PMMA). This is carried out to ascertain the effectiveness of stone treatments applied to fresh Mokattam and Tura-Ma'sara limestone, which were extensively used in ancient Egypt (e.g., Saqqara and Giza plateau).

Reflections of Aesthetic Culture Composed by Cultural Memory on the Urban Space

Nimet Mert Ağar, Hüseyin Cengiz, and Arzu Kocabaş

Abstract

The method used in this study comprises of creating a literature research based on the concepts of culture, memory, cultural memory, aesthetics, art as the expression of aesthetics, and aesthetic culture and building a series of conceptual frameworks of aesthetics of urban space as a result of this reading and examining process. The approach that makes the basic proposition of this study is that "the examination of the physical structure that generates the general appearance of a city is insufficient to define urban aesthetics." While the process and outcomes of the elements directing our culture, such as "social justice, quality of life, and ghettoization," are the most prominent problems to be solved, we should prefer "innovative" attitudes, behaviors, methods, and means rather than "new" ones for development. Memory provides cultural transfer in every matter together with reminiscence. Cultural memory derives from customs and communication but is not identified by them. While human, capital, and culture mobilization are gaining impetus with globalization, cultural memory elements have become a consumption material and amnesia has risen. When we consider the relations between modernity and memory, we observe a constant progress and "memorylessness." The real world that has no relation to an ideal has no aesthetical value. When the existence of aesthetics is considered, "criticism must be a vision of the world and a philosophical method." This does not happen at a moment's notice. Aesthetic perception is a kind of perception that discovers the infinite secret force that belongs to the object. We flourish as we perceive the richness of our surroundings. Besides, the most ethical judgment is aesthetic judgment. This is the sign that shows how important the concept of aesthetics is in our lives. Although we say there is a relative independence for aesthetic value, it can be a means of exploitation against the pragmatic value of the object it belongs to. In this respect, art as the carrier of cultural memory renews itself for the notion of building the ideal rather than rebuilding the reality. Spatial creations with applied arts reveal not only the technical improvement of a society but also the lifestyle, way of thinking, vision, understanding the ideals, and psyche of different social layers. Aesthetic culture is our way of life, reflected in urban space, that has been passed to us from our ancestors, is revealing our attitude and behaviors toward our surroundings naturally and unconsciously, by the summation of social experience, and is produced socially by our mental structure. Globalization threatens our cultural memory, and the culture industry jeopardizes our aesthetic culture. That's why, urban aesthetics is under threat. Under these circumstances, reaching the ideal for aesthetics of urban spaces, based on today's quality of life, the "unique" creativity in the reality of time with fictions, made with the help of art, embracing the self without denying universality, far from individual profit, in accordance with social decisions, must be inevitable.

Keywords

Culture • Memory • Cultural memory • Aesthetics • Art • Aesthetic culture • Aesthetical urban space

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1 Introduction

Although the harmony in urban space that is perceived sensually exhibits its beauty, the assessment of the physical structure that makes up of the general appearance of the city

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is not adequate to define urban aesthetics. The actual element that defines urban aesthetics is the aesthetic culture that is created by the cultural memory in which it belongs to.

1.1 What Is Culture, Memory, and Cultural Memory?

From the eighteenth century, culture that gives meaning to the product of intellectual and artistic activity (Williams 2013) is everything that individuals, communities, and societies produce historically and the social structuring that comes consequently. The ideals of each individual, community, and society are different. That's why, cultures are different.

Progress happens with the improvement of knowledge and skills man gains through his life. Progress is not repeating the existing. Every kind of innovative attitude, behavior, method, and tool that is identified in order to materialize the ideals of different cultures produces a different result from the new ones leading to culture in our life. "New" requires an external autonomous force to create a sudden and comprehensive change in a definite cultural space, pushing aside the available forms. Donald A. Crosby argues that "innovative is the principle of 'innovation,' that is to bring innovation by making a choice among the options gained from accidental process." Consequently, the innovation is never the copy of the available form; it is always a different formation. The reasons prompt the act of bringing innovation that results in different forms, while innovative forms help conceive the reasons. The innovation is not the product of revolution, but it is the product of evolution (Moussavi 2011).

The life standards of every individual, community, and society are different and define another element of culture. The essential economic and social needs of man must be met in order to generate quality of life. As stated by Maslow in his theory of "hierarchy of needs," a man in financial difficulties wouldn't make his decisions in favor of cultural activities.

The third element leading to culture is social justice. According to Marx, "the dominant culture oppresses the non-dominant one in the cultures where social justice doesn't exist." As a result, the culture has no autonomy. On the other hand, in the medium in which political applications limiting the freedom of individuals, communities, and societies take place and in wars where peace is not dominant, the reflections of the changes in cultural dynamics that operates in their own rhythm are considered by the survivors as unstable demands and behaviors depending on needs (Williams 2007).

The fourth element leading to culture is ghettoization. Cultural assimilation process begins if the society is deprived of democracy, peace, and the right of freedom. This, consequently, results in ghettoization, which is one of the most important problems of cities resulting in the negative physical reflections of ghettoization on aesthetic of urban space.

The enrichment of culture can only be achieved by adding new items to inherited ones. When the culture is considered as a social structure and historical product, without a conservative view that limits the concept of culture down to a cultural heritage, it can be said to head toward the future, not the past, and broaden through creating new ways of thinking, living, and acting (Oğuz 2011). Culture changes, and this change takes place through adaptation (Güvenç 1991). The impetus for cultural change has increased in today's society.

Memory is what we carry from the past to present and future. We can consider it as one of the series of impressive tools that are used to represent situations that do not exist. Memory is in the center of conventional theories in which it is presented as "review of the past" and "the foresight of the oncoming events" (Boyer and Wertsch 2015). We need our memory to imagine. The realization of transmission of experience, via directive function, provided social function and cultural harmony. Memory is a phenomenon necessary for human development and provides potential information from the past that is related to the present. The produced knowledge is related to what's recorded in our memory, and this accumulation will direct our improvement.

The past that we belong to seems to create the rationality levels in our apocalyptic fictions in favor of society. Memory that deals with the "simulated" remnants of lingering and lost events in our minds, on the other hand, provides a cultural transmission, since it covers the knowledge of natural and social systems, skills, and habits along with remembrance (Boyer and Wertsch 2015). The content of memory, the organization of this content, and the duration of preservation are determined by the conditions of social and cultural environment, rather than the capability and tendencies of the individual. It does not matter what we keep in our memory, but it matters what we are doing and producing right now. The words that depict us are not what we are saying now, they are the ones that we spoke in the past. Moreover, the things that put us through are not what we say today; they have become the ones that we said in the past. When the history in the memory, which is the recorder of human history and individual history, and a reservoir where the knowledge can be found and used when necessary, is instrumentalized instead of being practicalized, the doors shall be open for beautification and glorification of history, rather than it being the founding element of the present and

the future (Assmann 2015). The duty of the memory is to remember and not to forget. Consciousness and memory ensure that each individual exists in interaction with his surroundings and thinks in a correlative way. Memory, which is the reason for the human to be in existence, is an ability that expresses the mental organization of man in the most capable way (Özak and Gökmen 2009).

Desjardins has questions about how to make the decision to reach a good future, because according to him, the source of our present problems is the result of the decisions that old generations have made, even with good intentions. For this reason, Des Jardins proposes to reflect past experiences into the decision process, looking back into the past before making decisions (Des Jardins 2006).

The past is evaluated as a vital and discernible phenomenon, for it is united with the sense and experience of the present; however, it does not stay in the past. It is shown by the fact that the groups in a society that form it and have different pasts have their own specific reminiscence in association with different meanings in their mental foundations. People have appealed to religion, language, and art to maintain the social order. Social memory, which is based on concrete social experience, is remembered by spatial frameworks, reminiscence, and reminders. Memory becomes socialized this way. Organizations and spaces fulfill the function of reminding. Personal memories and social memories unite and conceive cultural memory. As stated by Recouer that "what is remembered is more important than who remembers it." This is the road to cultural memory (İlhan 2015).

Individual memories create an experience of a common identity and a common niche, and they are articulated in a collective identity and cultural memory that passes on from generation to generation, which is not limited to human life span. When there is a disruption in any of the elements that conceive cultural memory, this creates a negative effect on cultural identity and cultural memory. According to Enzo Traverso, "in today's life everything is built on memory." It is transformed into collective memories by sorting out past, cultural, ethical questions and according to current political appreciations (Traverso 2009).

Assmann says "cultural memory nourishes from customs and communication but is not identified by them." When the new has a meaning beyond its purpose, the borders of mimetic memory and human development are launched. Customs belong to the area of cultural memory as a way of transferring and vitalizing the cultural meaning (Assmann 2015). While human, capital, and culture mobilization are gaining impetus with globalization, cultural memory elements have become a consumption material and forgetting has risen. When we consider the relations between modernity and memory, we observe a constant progress and memorylessness. That's why, urban aesthetics is under threat.

Cultural heritage shapes the appearance of cities that are formed by economic, cultural, and social values, and it becomes the symbol of the culture that they represent in memories. An individual, who can perceive the sociocultural features of the space he is living in, develops a certain level of awareness. The conservation of the elements of cultural heritage creates the medium for the improvement of creative thinking, raises the consciousness of being urbanized, as well as strengthens social belonging. Cultural heritage also, as an element of social memory, creates a bond between the past and the futuristic side by reflecting and helping share the social reminiscence. It also contributes to the development of conservative and appreciative behavior toward the environment where the society lives without being a status quoist. The societies that are aware of their cultural heritage are made of individuals who protect their cultural richness diligently and have an improved conscious to transfer them to the future (Aksungur 2010).

1.2 What Is Aesthetics?

Kagan argues that humans improve and solidify their aesthetical connection to the world, when the axiological and gnoseological functions dissociated from each other by their own value orientation. Aesthetics is both individual and post-aesthetical. Aesthetic conscience is societal. The most ethical judgment among all the others is aesthetic judgment. The aesthetically assessed is the reflection of the humane ideal in a structural integrity, the cosmic ideal of systematic capability that ends chaos, the ideal that both deals with and is far from entropy, that the man senses in himself. The ideal is also as tangible as the image of art (Kagan 2009).

Aesthetics has the role of a driving force of the advance of humanity by referring to new sites of experience and new life possibilities. Aesthetics disconnected from criticism or criticism disconnected from aesthetics is unthinkable. The result that aesthetics without criticism would reach brings forth the concepts of abstractionism and scholasticism.

The essential duty of aesthetics is to include, along with the laws of nature, the operation of consciousness in the pleasure gained from a work of art. Theoretical principles and scientific method of aesthetics are directly related to the methodology of philosophy and the vision of the world that it belongs to every period of time.

The concepts regarding aesthetics are explained below in order that aesthetics is fully comprehended.

1.3 Ideal

Aesthetical relations are built directly on individual authenticity, uniqueness, and non-recurrence of the object,

and show the necessity for a measure to create a bond between the individual and its tangibility, which will come to light together with it. Ideal is the definition of this necessity. Humans are not born with the notion of how life should be. These notions are formed in man's consciousness in relation to the requirements and confrontations with demands and challenges he experiences through life. As a result, every social class has its own ideal, more or less different from others. Again, for the same reason, the ideal of each and every individual is different from the others in one way or another (Kagan 2009).

The relationship between the real and ideal is the aesthetical experience. A spiritual lifestyle, without any profit motive, can be achieved by building the relationship between the ideal and the object. Mankind's ability to create a social ideal is related to the historical dimensions by nature and origin. Ideal is the transformation of what exists to what does not exist, but is wished to exist or obliged to exist, what is not possible to exist from time to time something fantastic, epic, and utopic. Ideal has tangibility. As humanity is the highest ideal, we design it as an eternal, advancing movement toward the more complete and higher ideals. Ideal dialectics has a contradictory structure. It sets the emotions and demands of humans in motion. The ideal in human consciousness occurs directly as notions. That's why its tangibleness depends on the concreteness of the notion. A tangible aesthetical evaluation of the object depends on the kind of relationship between the reality and ideal. The real world that has no relation to ideal has no aesthetical value (Kagan 2009).

1.4 Aesthetic State

Kagan determines two preconditions for the emergence of the aesthetic state, via defining the aesthetical element as the sign of both form and content. The first condition for the emergence of the aesthetical state is that a direct and sensual relationship is built between man and object. The second one is the location of the subject that has a relation to the state. The concept that Kant defined as "disinterestedness" is described as "out of interest" by Chernishevsky. The aesthetics between man and world is a vision of man's social interests. Thus, the aesthetical state can only be mentioned in terms of human behavior toward an object that does not have a self-seeking and selfishly consuming feature and does not present a tendency to possess the object, relieve his biological requirements and wishes, make use of its certain properties, or use it in the name of a target to make himself more charming. The state of having overstepped balance, harmony, and conflict exists in aesthetic state. Man is at the point of being free. That's why, he must fight to protect the state of balance (Kagan 2009).

1.5 Aesthetic Knowledge

The pleasure gained from the beauty of an object does not come from the desire to possess and use it for a certain purpose; aesthetic knowledge distinguishes itself from scientific and theoretical knowledge in the process of obtaining pleasure from the beauty, not the outcome, because aesthetic knowledge has no other objective than itself (Kagan 2009).

1.6 Aesthetic Perception

The scientific research on perception shows that the consciousness is lowered when the external stimuli decrease, and if there is no stimulus, consciousness does not exist. Aesthetic perception is a kind of perception that discovers the infinite secret force that belongs to the object. We flourish as we perceive the richness of our surrounding (Erzen 2006).

1.7 Aesthetic Consciousness

Aesthetic is individual, but aesthetic consciousness is societal (Ziss 1984). Aesthetic consciousness is produced by the effect of social relationships. It refers to a qualitative vault from plain animal pleasure level to a spiritual pleasure level related to being a human, from the level of instinctive orientation of an organism to the level of gravitation that has a standard of value (Kagan 2009).

1.8 Aesthetic Value

The historical development of aesthetic consciousness has shown us the limit that exists between the laws of mathematics and aesthetic values. Being completely linked to the form causes the aesthetic force to diminish when regularity, suitability, and legality are concretized and become totally subject to form. Aesthetics does not refer to a strict regularity. Aesthetic value is the relation between entropy and the act of information, which is located in the system differently from its original significance so that it carries in its own content. Form, as the content of the object, is the carrier of aesthetic value, but it is not the value itself, because the form that belongs to the object is an existential condition and independent of the existence of the subject. Value pronounces the significance of the object. The regularity level and the inner regularity of the form are not aesthetical; it is the fundamental law of material existence; transformation of the features of the form of an aesthetic value can be achieved only when they are included in the ideal design and modeled in this ideal as a high target that man always and everywhere

struggles to reach. This is the road to creativity (Kagan 2009).

2 Art as the Way of Expression of Aesthetics

Art has been multifunctional, from the beginning. Art is the way and style to model the circle of humanitarian value in order to transmit this message via a series of semiotic signs. Art is the reproduction of reality through images, and it is the concept of building the ideal. If art had an object of knowledge, as science does the imagery styles of art would vanish and empty images of scientific discoveries would take their place (Kagan 2009).

The form of a work of art contains the aesthetic manifesto that it is supposed to convey to others, while embodying and objectivizing the content. Artistic form is the objectivization of content. The knowledge manifesto, detected in the content of art and objective reality as the content of scientific information, dissociates from each other. The unity of objective and subjective reality is poetic reality and is the primary condition for a work of art to gain artistic value. This is the primary difference in art from the content of science. As long as the emotional and intellectual aspects of poetic content do not overwhelm each other, poetry in art can protect its own existential quality. In case that the emotional aspect dominates, modeled artistic image degenerates and the domination of intellectual aspect, on the contrary, leaves nothing but just the expression of rational thinking (Kagan 2009).

Art has a social value. It is the unique product of human activity. The transformation of an individual's experience into common spiritual goodness refers to the interest in the fast advancement of the whole society. In aesthetic education, art has a special role. In fact, most thinkers agree that art is not the only but the primary tool for man's aesthetical disposition.

The formation of a sociocultural heritage in humans, and the power that man possess to transfer his value bearing and mandating experience with specific mechanisms, has conceived the need for an artistic activity, which is the most significant and important human discovery. Art has gained operability as the semiotic model of vital human activity (Kagan 2009). Art always presents an open language for the whole of humanity, along with possessing its own nationality. It has a high value in terms of advancement of the society. It is the organization of our future behavior and goals for the time ahead.

If the methods of artistic assimilation of the world were denied and new methods were applied, the success, mastership and culture in artistic experience would vanish. Hence, the contradictory unity of the temporary and the permanent must be mentioned here. As a matter of fact, this is what shows us the evolution of artistic content. Men reach the conscience of their own lives, their attitudes toward the world surrounding them, and their social endeavor through art.

Rancière argues that the existence of art, like the existence of human rights, morals, law, and politics, depends on the practice of disagreement. The singularity of neither ethical community nor modernism that denies heteronomy can build this agreement. This can only be created by the aesthetic regime established by the uneasiness between the politics of art being life and life being art (Rancière 2012). Rancière described this unease as two separate and opposite aesthetic views (Koylan 2012).

2.1 What Is Aesthetic Culture?

Man is in interaction with his environment, and his psychological, physical, and sensorial needs, stimulated by his surroundings, are placed, as much as his basic needs, in man's cultural unity. There has been no approach concerning the establishment of man's environment that demands it to be just functional from past to present. It can be observed that even the most primitive planning is conditioned by psychological, physical, and geographical factors. Man used signs, consciously or unconsciously, while meeting accommodation needs. He used his dysfunctional, crafted tools as ornaments, and he added symbols to them. The ancient cultural elements may be primitive, but they were just made for perception and learning. However, these cultural elements gained the role of a guide and director in time and became the factors to hold the social group together. Social life can only exist this way. The harmony of man and nature will rise, and their bond will strengthen thanks to these aesthetically significant forces.

Cultural identity is to look out for customs, historical, and spiritual values. However, cultural values are neither traditional nor retrospective. The roots of the above-mentioned value date back to old times, but they have creativity and dynamism in today's living conditions. The swiftly rising human population, the interaction among different cultures, as a result of international mobility caused by globalization, tourism, or business are changing today's human being quickly, and this change is reflected in that are the physical environment and also alters the concepts effectual in this physical environment.

In today's era of capitalism, there is a contradiction between artistic culture, with the thought of democratization, and the notion that the great part of society cannot build an aesthetic existence by exploiting artistic values (Kagan 2009).

Aesthetic culture is our lifestyle that has been passed to us from our ancestors, built naturally and unconsciously by the summation of social experience, is revealing our attitude and behaviors toward our surroundings, and is produced socially by our mental structure.

2.2 Basic Approaches in Discussions of Globalization from the Cultural Perspective

Two different approaches are observed between pragmatists and theoreticians that examine globalization within the scope of culture. While theoreticians evaluate globalization as a homogenous process with an indefinite beginning and end, pragmatists see it as a heterogeneous and intercultural process. Giddens can be an example of proponents of the first approach. His interpretation of globalization is related to transformations in space and time, and he thinks that the first condition of globalization is to liberate time from space. Social relations become dependent on space and can interact with the distant thereby. Giddens also considers globalization as a result of modernization. Modernization makes social relations widespread and provides relationship networks among communities. In this way, the relationship between the local and the distant improves (Aksungur 2010).

According to Keyman, the traditional is derived from the modern by degrading the differences among non-modern societies to traditional via binary typologies, such as "modern–traditional," "occidental-show that universalization," and "east–west." He states that acknowledgment and acceptance of cultural diversity are not a problem that can be solved only by including culture in the theory of globalization, where existence is determined in accordance with the modern; on the contrary, it can be handled with recognition of diversity of cultures in other geographies beyond modern (Aksungur 2010).

The widely accepted view is that the fundamental characteristic of globalization is the tension between "universality" and "locality." In his article "The End of History" and "the Last Man," Fukuyama lays emphasis on that fact that the decomposition, in other words the cultural homogeneity, occurs as a result of the belief that liberal market ideology becomes universalized with globalization of capital, by exhibiting a status of differences being the same; on the other hand, global and political practice, ethnic, local and national conflicts are signs of cultural heterogeneity. Additionally, Appadurai states that "the primary problem of today's cultural interaction is the tension between cultural homogeneity and heterogeneity" (Aksungur 2010).

Robertson used the term globalization to emphasize the relationship between local and global, as "creation and inclusion of locality." The association of local and global shows that universalization of the local can be much different from localization of the universal, due to the fact that it touches on the spatial relativity related to the concept of globalization (Aksungur 2010).

Interpretations are being made with concepts like "articulation," "creolization," "engraftation," and "hybridization," in addition to the concept of primary globalization (Aksungur 2010). The rich local culture of humanity and methods of production based on this culture are threatened by globalization. Nevertheless, with the fast spread of mass culture, diversity of cultural expression of humanity is face to face with extinction. The negative influence of mass culture created by globalization and capitalism threatens cultural memory and aesthetic culture.

2.3 Effects of Globalization on Traditional Culture

Consumption depends on volition conditions of society. Today, the local and traditional have been stripped off their idiocratical features and transformed into the meta of consumption culture. This way of thinking detracts tangible and intangible elements of cultural heritage from their identity and turns them into revenue generating tools for consumption culture and unapproved tourism methods.

2.4 Reconsidering the Culture Industry

Culture industry is to combine the old and new in a new quality. The products that are designed in accordance with mass consumption and define the characteristics of consumption significantly are manufactured according to a plan in all sectors. As Brecht and Suhrkamp expressed years ago, cultural goods that belong to the industry are managed in accordance with market value, rather than contextual and structural harmony. All sectors are similar to each other in terms of structure, or they cover each other's drawbacks and build a system of no handicaps. This is a managerial and economic intensification with modern technical possibilities. The aim of culture industry is to orientate consumers toward themselves. The goal of culture industry is to transfer the profit drive to cultural forms. The improvement of consumer awareness has a great importance (Adorno 2003).

Everything that is qualified as advancement and always praised as new by culture industry contains an eternal uniformness with no beginning or end. Culture industry is at the service of third parties today as it has always been. It protects the proximity of capital to declining circulation process and trade, which is its raison d'être. The operation formula and content of culture industry popularize high personalities that cannot become real and succeed in its role by staying at a distance from being humanitarian. The lessons to be taken

from the products of culture industry and models of behavior are completely inappreciable for they are banal, irrational, or pandering. The main role of culture industry presents itself against enlightenment. This role is significant in terms of hindering the liberalization of the society (Adorno 2003).

The term technique used in cultural industry, in opposition to technique used in artwork, is related to mechanics, distribution, and reproduction from the beginning. That is the reason why it stays external to its object (Adorno 2003). It exists by making use of an exaggerated artistic technique that is used in the manufacturing of goods, and while doing so, it ignores the responsibility toward the internal artistic unity implicated by its functionality, and it disregards formal laws as a requirement of aesthetic autonomy.

Attempts to bring forth the problems of the quality of culture industry, mention its rights or wrongs, question aesthetic ranks are alienated and hindered because of its social role. Culture industry is an important factor that harms aesthetics and therefore aesthetic culture on the basis of not being open to criticism.

3 Reflections of Cultural Memory on Aesthetic Culture

Reflections of cultural memory on aesthetic culture are through art.

Cultural memory has had very special protectors and carriers in different periods. They were shamans, bards and priests at the beginning. Then, teachers, writers, and philosophers took over the duty. Artists are the creators, carriers, and fighters of cultural memory, defending it against time (Giray 2001).

Cultural memories of the past belong to all of us. Not only the artist's own cultural past but also the knowledge of all cultural values of the world give him a significant point of view for his works. The struggle to comprehend the essence of art nourishes the artist helping him establish his own art. The "usefulness" and "beauty" of this bear importance. The direct application of the art of past cultures is imitation, and it does not have any content in that case. The real art can only be reached when it is handled with contemporary artistic measures. Furthermore, it is a possible synthesis of cultures. The methods of using traditional sources as a means of expression have always existed, and it is an important fact. The effects of different geographies, cultures, daily lives, humans in their daily lives, the traditional handicrafts that the same humans craft and the experience of centuries can be observed in various branches of art, and this creates opportunities for brand-new compositions to emerge in contemporary art (Giray 2001).

The classics of scientific doctrine have emphasized the endless cognitive abilities of art, its great role in the enrichment of human knowledge (Öztop 2010). The creator, protector and sustainer, carrier roles of art for cultural memory grow even more different with the art dealing with time in its own reality. Thus, every human activity that provides a cooperative unity with the environment and is densely blended with environmental consciousness falls within the scope of aesthetics. Aesthetic quality has an intense continuity with positive science and has intertwined with environmental factors (Giray 2001).

Time is always considered as an element, field of work, and transformer of art. Architecture is one of the leading artistic branches in terms of the carrier duty. "In the deep psychological level, our being architects is our self-crafted memory; both great architecture and anonymous works are our legacies." Each object produced by a different branch of art should be accepted as units that make up cultural memory. They are not just historical remnants. They belong neither to present nor to past or future. They belong to forever and never (Giray 2001).

The danger of losing the culture, critical discourse, and autonomous art becomes an open victory for culture industry and deaestheticization. The fact is that the area that is called as culture industry finds itself a great area of practice now. Accordingly, Giray states "unfortunately, culture can never be rid of the wheels of culture industry" in this area of practice. The greatest danger for culture and autonomous art is culture industry and deaestheticization (Giray 2001).

4 Reflections of Aesthetic Culture Composed by Cultural Memory on the Urban Space

Urban space that is used by urban residents has a dynamic characteristic that always represents a different lifestyle with its aesthetic features. The aesthetics of each urban space is evaluated separately, because they have come from different pasts and have different cultures.

Today is said to be a period of time, when the richness of cultural expression that all mankind possesses, vanishes and dedifferentiation emerges instead. And these have echoes in the relation of urban space to its aesthetics. "Uniqueness" and "unrepeatability" of urban space composition disappear due to dedifferentiation. Culture has no autonomy. The aesthetics of urban space where it belongs can be mentioned only depending upon which circumstances the cultural medium is under. Statements concerning justice do not get separated from competing statements related to the contingency in the society (Harvey 2013). The dominant culture oppresses the non-dominant one in the cultures where, as explained by Harvey, "the application of fair principles for conflicts that social justice" doesn't exist and cultural assimilation process initiates if the society is deprived of democracy, peace and the right of freedom. This, consequently, results in

ghettoization, which is one of the most important problems of cities and resulting as the negative physical reflections of ghettoization on the aesthetic of urban space.

Corruption, together with the change of urban texture, which has reached its present shape after many alterations and composes the present aesthetics of the city, causes a loss of meaning of cities. Moreover, this is reflected onto the urban dweller. He grows away from the consciousness of being an urbanite; his sense of belonging vanishes. The aesthetical loss in urban space lowers the quality of life of the individual (Aksungur 2010). Aesthetics and quality of life are in interaction all the time.

Urban spaces that carry on their existence for the ideal, composed in order to meet daily needs with all their accumulation of knowledge from the past to present, reflect their aesthetics in the reality of time in which they belong to.

Sensations, perceptions, and recollections related to space establish a context with the phenomena of learning and experience and the qualities of the environment of urban space. Then, this is recorded in the memory and associated. Here, the quality of urban space is about the aesthetics of urban space. It comes into the light with past experiences and remembering the effects of spatial aesthetics on minds. Today, the reflections of these on individual and physical reality of space are determined by these conditions (Özak and Gökmen 2009). The aesthetic awareness of society is shaped by the remembrance, after being stored in the memory, of the codes that are made by the relation to the lifestyle and the context that emerges with the perception of space of the past in the composition of the memory of urban space aesthetics.

The aesthetics of urban space of the past has an influence on the establishment of today's aesthetics of urban space. Today will affect the future; the storage of spatial elements in memory is variable. The higher the number of contexts, the more lasting spatial memory will be. Conscience decreases as environmental stimuli diminish, and when the stimuli vanish, awareness is canceled out. This is the feature of perception in memory that is exploratory and developmental for man. When artistry, which is the way of expression of aesthetics in terms of environmental stimuli, increases, the permanence of spatial memory can be said to go up with the rise in the exploratory and developmental features of perception. The feeling of pleasure that is sensed by man comes as the cherry on top. Today, it is utilized in education.

There are natural, cultural, and historical monuments of various periods in time, in our country and the world, that have artistic and documentary values. If we fail to preserve and transmit these aesthetic values to the next generation, the people will not look for or recognize what they are missing because they will not have any information about these aesthetic values. Besides, their lives will be left depleted, meaningless, and incomplete due to these undelivered aesthetic values. Aesthetic value must also be searched for in the disidentified space without being a protectionist. Space is the means of transfer for cultural memory.

Urban spaces are the means of social expression. If the expression is not fulfilled, there occurs social memorylessness. The space that resides in memory is important for social memory. The change in the individual of a society can be observed in the relationship between space and memory. For this reason, the relationship between space and memory is significant for social memory, thus for the cultural memory that it creates. Space is the bond between the man's individual memory, his world of emotions and recollections and society. The space is needed to create a connection with and memory of the past. Spaces create the sense of belonging, and that's how identity is constituted. Where space disappears, there is a disidentified individual and society (Pösteki 2016). The history of space and its transformation is related to how the ways of the collective memory are now embodied (Mills 2014).

In the modeling of the architecture, especially the housing, of a certain period, great are the effects of sociopolitical and socioeconomic structures, traditions, customs and cultural environment spaces and their being of artistic value, on the individual's gaining of a social aesthetic consciousness by remembering the space increasingly. The social aesthetic advancement in cities is achieved by these means (Özak and Gökmen 2009). Today's modernism and economics change our cities (Jacobs 2011).

The precondition of the emergence of aesthetical state in urban space is the establishment of a direct and sensual relativity between man and the physical urban space. The second condition is individual, class, and social disinterestedness about urban space. Aesthetic interests to be gained from urban space are that man protects the space and does not use it for his own biological desires or demands, does not make use of the superiority of the object if there is any, does not utilize the object of the urban space for a certain goal to thrust himself to the forefront.

The formation of the city cannot be based on a formula (Landry 2012). Therefore, the aesthetic beauty of the urban space should not be considered and researched as a different feature. The transformation of the features of physical urban space into aesthetical values can be possible by an ideal design and by modeling them in a social and universal ideal as a higher purpose. Each society has its own ideals. Therefore, the reflections of aesthetic judgment on physical space differ if they are different. In the process of establishment of urban space, every ideal has an aesthetic element, and this provides the relationship between the ideal and the process.

Practice that takes place at different times in various places in urban space will yield aesthetically different

outcomes. Aesthetical evaluation is made in the reality of time. A contradiction occurs between aesthetic value of the urban space and ethical, pragmatic, or political value, and this is very natural. A conflict arises between the pragmatic, ethnic, and political value of the content in the aesthetics of urban space and the aesthetic value of the form. Although we say there is a relative independence for aesthetic value, it can be a means of exploitation against the pragmatic value of the object it belongs to. In this respect, art, which is used as a tool for formation, transformation, and change for the urban spaces, renews itself for the notion of building the ideal rather than rebuilding the reality.

Aesthetics itself as a new science is individual; however, aesthetic consciousness is social. This is also reflected on urban space. Aesthetic thinking, which is at the same time an artistic thinking for the self-improvement and self-development of urbanites, has the role of a motivator with its reference to new experience opportunities and life possibilities during the establishment of urban spaces.

Research on perception shows that the consciousness is lowered when the external stimuli decrease in the urban space, and if there is no stimulus, consciousness does not exist in the urban space. Aesthetic perception is a kind of perception that discovers the infinite secret force that belongs to the object. We flourish as we perceive the richness of our surrounding.

Being completely linked to the form causes the aesthetic force to diminish when regularity, suitability, and legality are concretized and become totally subject to form in the urban space. Aesthetics does not refer to a strict regularity in the urban space.

Art has gained operability as the semiotic model of vital human activity in the urban space. Men reach the conscience of their own lives, their attitudes toward the world surrounding them, and their social endeavor through art in the urban space. Aesthetic urban space is created by the aesthetic regime established by the uneasiness between the politics of art being life and life being art.

Artistic value can only exist as long as the physical asset regarding space carries the information of the spiritual life of the society in its own tangible appearance. Spatial creations with applied arts reveal not only the technical improvement of a society but also the lifestyle, way of thinking, vision, understanding the ideals, and psyche of different social layer. Art creates and carries the aesthetic culture composed by cultural memory in urban space.

Making use of the poetic reality in architectural creations and applied arts for building the urban space will not only give artistic value to the space, but also provide the cultural establishment, chance, and transmission in the space through the preferred means of art. The establishment, change, and transmission of aesthetic culture depend on it.

There are cultural differences among several social lives, and the evaluation of the concept of aesthetics varies according to societies and cultures. There are free men where culture exists. Art is the phenomenon created in such a culture-based environment. Art teaches us to be free. Aesthetic sensations develop with artwork. We seek and investigate aesthetics through art. In this manner, many themes of our lives get touched on because the investigation of aesthetics is carried out via living. Art nourishes culture and this helps men put their lives in an order, leads, and lightens their way.

When we examine the stages of change of culture from the past to our day, it can be said that the urban underwent mostly the change that came with globalization. Globalization, the gradually increasing effects of which are being felt from the mid-1980s, is a fact that has influence on politics, economy, society, and culture and is changing swiftly. The tendency to lose the diversity of cultural expression and have a monotype lifestyle causes ignorance of the preservation of urban values. The change of cultural structure and the reflections of this change on space present itself as a disharmonious, disorganized, and disintegrative development in cities. This is the reason why we come across terms such as over identity, deaestheticization, or corruption in connection with cities.

5 Conclusion and Suggestions

While the process and outcomes of the elements directing our culture such as "social justice, quality of life, and ghettoization" are the most prominent problems to be solved, we should prefer "innovative" attitudes, behaviors, methods, and means rather than "new" ones for creations.

Memory provides a cultural transfer in every matter together with reminiscence. Scarcity of stimuli causes paucity of consciousness of the urbanite. Utilization of art in urban space provides a stronger memory for the urbanite. The more remembering is, the higher aesthetic conscience goes, and this reflects on urban space. The conscience of being an urbanite and life quality are defined and sense of belonging and identity emerge.

Cultural memory creates a bond between space and the individual. Aesthetic development in urban space is provided by cultural memory. If we fail to preserve and transmit these aesthetic values to the next generation, their lives will be left depleted, meaningless, and incomplete. Space is the means of transmission for cultural memory. Corruption, together with the change of urban texture, causes a loss of meaning of cities. Cultural memory nourishes from customs and communication, but is not identified by them. While human, capital, and culture mobilization are gaining impetus with globalization, cultural memory elements have become a

consumption material and forgetting has risen. In the face of globalization, the tension between locality and universality leads to the disappearance of cultural richness, resulting in the loss of the uniqueness and unrepeatability of urban spaces. When we consider the relations between modernity and memory, we observe a constant progress and memorylessness.

The real world that has no relation to ideal has no aesthetical value. When the existence of aesthetics is considered, "criticism must be a vision of the world and a philosophical method." This does not happen at a moment's notice. Aesthetic perception is a kind of perception that discovers the infinite secret force that belongs to the object. We flourish as we perceive the richness of our surroundings. Besides, the most ethical judgment is aesthetic judgment. This is the sign that shows how important the concept of aesthetics is in our lives. Disinterestedness in relation with the urban spaces is that man protecting the space and not using it for his own biological desires or demands, not making use of the superiority of the object if there is any, and not utilizing the object of the urban space for a certain goal to thrust himself to the forefront.

Aesthetic value is the relativity between valuation and entropy in the formation of urban space; form is not an aesthetic value; it is the carrier of aesthetic value; a conflict arises between the pragmatic, ethnic, and political value of the content and the aesthetic value of the form. Aesthetical value is possible by a social and universal design in the formation of urban space; aesthetical evaluation is made in the reality of time.

Although we say there is a relative independence for aesthetic value, it can be a means of exploitation against the pragmatic value of the object it belongs to. In this respect, art as the carrier of cultural memory renews itself for the notion of building the ideal rather than rebuilding the reality. In the process of establishment of urban space, there is a relationship between the ideal and the aesthetics. Each society has its own ideals; therefore, the reflections of aesthetic judgment on physical space differ.

When nature is conceived mentally by humans, the existence of aesthetic reflections can be mentioned. In this day and time, the inability to build a one-by-one relationship with nature results in a decrease of human perception toward nature; thus, the aesthetic value of nature cannot be clearly understood. Aesthetic consciousness is societal. Aesthetic thinking has the role of a motivator for self-development and self-improvement of mankind. In aesthetic state, balance, harmony, and conflicts are overcome. Man is free, and he must fight to preserve his situation. Therefore, being completely linked to the form causes force to diminish in the urban space.

There is always need for artistic activity. People recognize their self-consciousness through art. The existence of art depends on the practice of disagreement. Due to its features and value, art is utilized for an aesthetical urban space. Spatial creations with applied arts reveal not only the technical improvement of a society, but also its lifestyle, way of thinking, vision, understanding the ideals, and psyche of different social layers.

Globalization threatens our cultural memory, and culture industry jeopardizes our aesthetic culture. That's why, urban aesthetics is under threat.

Suggestions

We have to gain awareness of our cultural, historical, and natural values that define today's aesthetic values, because their loss will result in negative irreversible outcomes. Abolishing something does not make it any better. Abolishment is a concept contrary to love and is not a right method. Traditional architecture must be preserved and sustained in the context of traditional culture. Architectural traditions are aesthetic reflections of cultural memory. Architecture has an active role in cultural construction and cultural transmission; therefore, traditional architecture is not only "an aesthetic reflection of culture" but also "the creator and definer of culture." The weakness of memory can only be overcome by the institutionalization and practice of a sustainable policy that is independent from persons in this institutionalization.

One of the problems related to the aesthetics of urban space is the weakness of cultural memory. The method to resolve this issue should be toward strengthening the memory of societies with decisions taken for the city. The thing to do is to open higher numbers of museums, art and culture centers, and art galleries in order to help people reach artistic sources. The policy for the employment of these centers should be regulated toward the education and training of specialists that have international knowledge and ideas and researchers that will protect and preserve art and make sure every kind of artistic activity reaches wide populations with the right methods. Consequently, urban dwellers will be able to have an artistic culture with the artistic education they receive nested in artistic lifestyle. Art has the power to influence human nature regardless of time and space. The beautiful is useful and it belongs to all of us. For this reason, there are many advantages that beauty provides. In this context, traditional art should be a resource for achieve the goals and contemporary art should be a part of daily life.

The measure to be taken for local culture against globalization must be respectful to cultural diversity and human creativity and include points of view that support protective precautions against the destructive effects of globalization on partial cultures. There are responsibilities and duties for urban dwellers. Every urban resident must protect his city

and have a relationship with it that allows him to feel and perceive it with all his senses. He must not forget his past and respect all the other cultures in the world while protecting his own. If a healthy aesthetic opinion system is established, aesthetics can have effects on urban space with the development of aesthetic taste. Education of individuals, communities, and societies artistically and aesthetically can be an example.

Art and culture should definitely be included in education. Educators have the greatest role in the education of individuals, communities, and societies. Art contributes to the development of the aesthetic consciousness of individuals from very early ages, and it must be endeared and popularized for the entire society. If we aim to educate members of professions for design and planning, we have to put great emphasis on the courses of aesthetics, art history, and culture. The contents of lessons for the education of designers and planner they will study, in the departments related to design and planning at universities, should include the physical criteria for the establishment of urban space as well as aesthetic concepts such as cultural memory and aesthetic culture.

Decisions made on law and regulations regarding urban planning should be societal and universal while protecting the locality. The aesthetics of urban space is by providing social justice, democracy, peace, and freedom, with the ultimate objective to raising the quality of life to the highest levels.

Our aesthetic evaluations should have a qualitative feature, conditioned socially and in a level of spiritual pleasure, and built toward a directive level that has measures for value. There always must be an environment for criticism in urban spaces; aesthetics without criticism brings forth the concepts of abstractionism and scholasticism. The transformation of the form in urban space into aesthetical values can be possible by an ideal design through the road to creativity. In aesthetic state, balance, harmony, and conflicts are overcome. For this reason, there must be a struggle for the protection of the state of balance.

There always must be, for the emergence of aesthetical state in urban space, the establishment of a direct and sensual relativity: individual, class, and social disinterestedness. Self-expression of urban space should be related to the present, not to the past. There is a great need for urban spaces that will promote one-to-one relationships with nature, will not diminish human perception against nature, and ensure that the aesthetic value of nature is realized.

Consequently, under these circumstances, reaching the ideal for aesthetics of urban spaces, based on today's quality of life, the "unique" creativity in the reality of time with fictions made with the help of art, embracing the self without denying universality, far from individual profit, in accordance with social decisions must be inevitable. The planners, designers, educators that build cities, and urban dwellers that live in these cities can only reach nature-friendly goals without harming the nature under these circumstances.

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Degree of Respect for Authenticity in the House's Restorations of the Medina of Tunis

Imen Ben Said and Fakher Kharrat

Abstract

Tunisia has seven sites inscribed on the world heritage list and one natural site. The Medina of Tunis has been registered there since 1979. It has about seven hundred monuments including palaces, mosques, mausoleums and also luxurious residences that have been restored by different actors. There are three actors responsible for the restoration of houses in the Medina of Tunis, the National Heritage Institute, the Medina's Safeguard Association and private investors. Although Tunisia has participated, through its experts, in the drafting of international heritage charters, such as the Venice Charter, and has approved documents such as Nara's document on authenticity, each actor restores in his own way. In this research, we want to evaluate the degree of respect for the authenticity and the principles of good restoration of the operations carried out by the three actors intervening in the houses in the Medina of Tunis. The study initially aims to define the general principles, then to evaluate the degree of respect for these principles and authenticity, by identifying the characteristics of the restorations of each actor and, finally, to draw general recommendations. We select the Model of Analysis, Theory and Architectural Experimentation as an analysis model. The corpus under investigation includes twelve houses restored in the Medina of Tunis, with four for each actor. It is found that the Medina's Safeguard Association is considered as the most respectful of the good restoration principles and authenticity with 70%. But contrary to what has been believed, the private restorations exceeded the National Heritage Institute with a respect of 65% leaving it in the last position with 59%. The study reveals the restoration tendency of the three actors. The tendency of the restorations of the Medina's Safeguard Association, with its architectural culture, integrates the respect for authenticity, historical and aesthetic values, which show the new additions. They adapt the houses to their new function and try to integrate harmoniously the new equipment. The tendency of private restorations is based on the respect for authenticity, historical and aesthetic values, by showing the new additions with minimal intervention and adapting houses to their new function, with a harmonious integration of new equipment. The approach of the National Heritage Institute is based on the culture of archaeology and history, which promotes restitution of the historical aspect and the original style, but neglects the integration of new reversible materials and new equipment. The different restoration characteristics allow us to determine general recommendations of good restoration practice. These recommendations tend to integrate restoration norms in legislation, to publish restorations, to encourage effective coordination between the National Heritage Institute and the Medina's Protection Association, to create a partnership with the private sector and to harmonize intervention on the heritage, which no longer depends on the actors' culture.

Keywords

Heritage • Respect • Authenticity • Principles of good restoration • Evaluation • Actors • National Heritage Institute • Medina's Safeguard Association • Private investors • Medina of Tunis • Model of Analysis, Theory and Architectural Experimentation

1 Introduction

The Medina of Tunis has been registered on the world heritage list since 1979. It was developed, thanks to projects of urban rehabilitations like the souks, as well as the tourist and cultural tour of Dar Ban Abdallah at the south of the Medina and the Sidi Ben Arous Street at its north. It was also developed, thanks to restoration projects with various uses as

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administrative, religious, commercial and residential buildings. These restorations include public and private historical monuments. The residences, having a great architectural importance, are considered as a representative sample of the restorations of these monuments. They are restored by three local actors who intervene in the Medina of Tunis, which are the National Heritage Institute, the Medina's Safeguard Association and the private investors.

The interventions of these actors are different. We want, in this research, to evaluate the degree of respect for the authenticity and the principles of good restoration, resulting from the international charters, by checking if the National Heritage Institute, as the official public institution, is the most respectful of these principles. We propose, at the end, to deduce general recommendations. We adapt the Model for Analysis, Theory and Architectural Experimentation, defined by Professor Stephane Hanrot, to evaluate the restorations. The corpus under investigation includes twelve houses restored in the Medina of Tunis, with four for each actor.

2 Materiel and Method

This part includes the presentation of the corpus and the Method for Analysis, Theory and Architectural Experimentation.

2.1 Corpus

The domestic architecture includes very interesting monuments, which suffered from degradation and had been promoted by restorations after the independence. In fact, a lot of residences were deteriorating because of the change of lifestyle based on the change of the original inhabitants, the renting houses by room[1] and divisions of inheritance.

This degradation was caused by over-density and lack of maintenance, unlike the religious monuments, the public buildings and souks which benefited from continuity of maintenance by the foundations of the 'habous'[2] and the interest of the Tunisian state represented by the National Institute of Archaeology and Art (which became the National Heritage Institute in 1993). Indeed, the National Institute of Archaeology and Art restored in priority the public monuments and urban tour between 1960 and 1970, such as the souks and the tourist and cultural tour of Dar Ben Abdallah. It did not begin to restore the residences, until 1980, because of their alarming degradation.

The first project of the Medina's Safeguard Association, was the restoration of Dar Lasram, between 1970 and 1972, which was transformed to its administrative service. "The restoration of Dar Lasram was a creation inscribed in the objectives of the Tunis-Carthage project, all of which concern the safeguarding of the national heritage. This UNESCO operation was destined to become a reference operation" (Heinz 1972). The Medina's Safeguard Association continued the restoration of the houses during the 1980s, 1990s and 2000s and also the restoration of public monuments and urban tour like that of Sidi Ben Arous Street. Indeed, "the activity of the association covered a complete range of interventions, from urban planning to rehabilitation, including new construction and restoration" (ASM 1990).

Private investors began to realize the significant potential of residence restoration in the Medina of Tunis since the 1990s and the 2000s. They multiplied their interventions after the revolution in 2011. We can say that the restoration of houses did not really begin after independence, but since the 1970s and especially the 1980s and 1990s. Certainly "the success of the development of the monumental heritage has had a repercussion on private owners. Some have taken the initiative to restore their homes into art galleries, bookstores and luxury restaurants. Businessmen, who know how to anticipate the needs and trends of society, find in heritage a gate for the future" (Gritli 2005).

To establish an exhaustive list of the number of restored houses in the Medina of Tunis, we were based in the public archive of the Medina's Safeguard Association and the National Heritage Institute, its websites, interviews with several architects responsible for these institutions, publications of the Medina's Safeguard Association and different magazines. This list, established in 2015, includes 39 residences, 13 restored by the National Heritage Institute, 11 restored by the Medina's Safeguard Association and 15 restored by the private investors.

We chose a representative sample of 30%, which allowed us to work on four residences for each actor, so a total of 12 restored houses. Actually, "the representative samples are called probabilistic […], they allow the generalization of the part for the whole, the calculation of estimates and statistical tests" (Paugam 2010). We present below the map of the Medina of Tunis with the location of chosen houses for the three actors and the characteristics of the different houses and images of their patios (Figs. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 13; Tables 1, 2 and 3).

[1]After independence, the inhabitants of the Medina deserted it, thinking that it was without interest, and they settled in the garden cities. They rented their houses by room. The tenants are often migrant, poor and could not maintain these houses which accelerated their degradation.

[2]The immobilization of a fund for the benefit of a religious foundation, mosque, madrassah, etc. so that it cannot be sold or given to ensure the maintenance and care of these religious monuments.

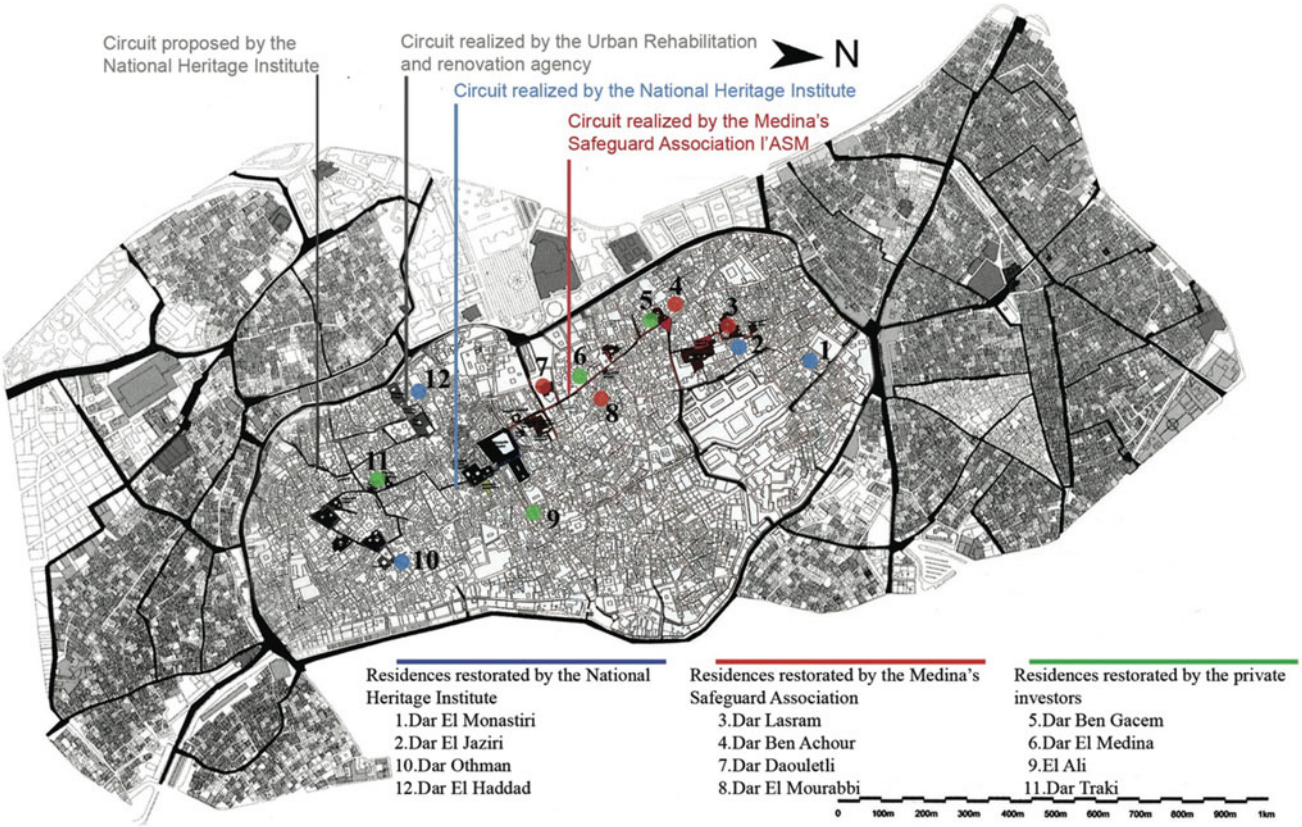

Fig. 1 Map of the Medina of Tunis with the location of chosen houses for the three actors (Ben Said 2016)

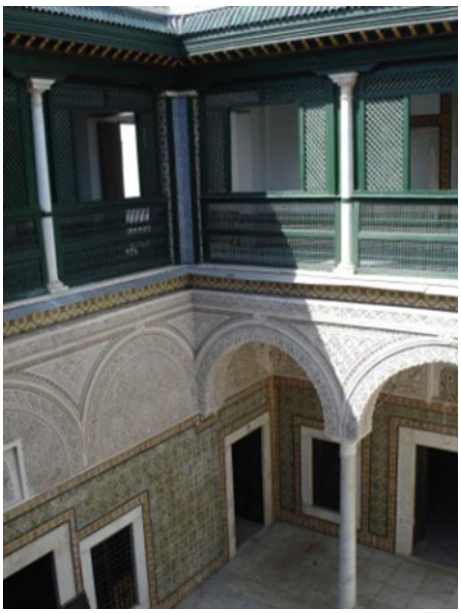

Fig. 2 Patio of Dar El Monastiri (author's photograph)

Fig. 3 Patio of Dar El Jaziri (author's photograph)

Fig. 4 Patio of Dar Othman (author's photograph)

Fig. 5 Patio of Dar El Haddad (author's photograph)

2.2 Methods

In this part, we present the Model for Analysis, Theory and Architectural Experimentation defined by Professor Stephane Hanrot, who is interested to new architectural projects, so we adapt this model to our corpus composed of restored houses.

2.2.1 Model for Analysis, Theory and Architectural Experimentation

To study the degree of application of the good restoration principles of the various actor interventions, we adapted the Model for Analysis, Theory and Architectural

Fig. 6 Patio of Dar Lasram (author's photograph)

Fig. 7 Patio of Dar Daouletli (author's photograph)

Fig. 8 Patio of Dar Othman (Mouhli et al. 2013)

Fig. 9 Patio of Dar El Mourabbi (author's photograph)

Fig. 11 Patio of Dar Ben Gacem (author's photograph)

Fig. 10 Patio of Dar Medina (author's photograph)

Fig. 12 Patio of Dar Traki (author's photograph)

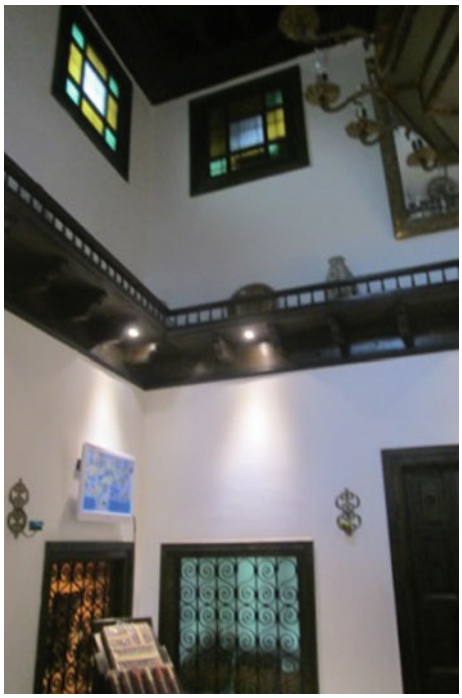

Fig. 13 Patio of the restaurant 'El Ali' (author's photograph)

Table 1 Information on the houses restored by the National Heritage Institute

Actor	Monument	Construction period	Current function	Date and duration of restoration	Classification as an historical monument
National Heritage Institute	Dar El Monastiri	XIXs	National Center of Translation	1981–2006 (25 years)	Classified on the 25/01/1922
	Dar El Jaziri	XVIIIs	Poetry Club	1993–1994 (1 year)	Classified on the 19/10/1992
	Dar Othman	XVIIs	Medina's Conservation Administration	1990–1994 (4 years)	Classified on the 25/01/1922
	Dar El Haddad	XVIs-XVIIIs	Administration of Museography	1981–2006 (25 years)	Classified on the 31/08/1999

Experimentation defined by the architect and professor Stephane Hanrot. Indeed, through this model, he is interested in evaluating the actor's points of view in the realization of new buildings, which follows the life cycle of the project from the programming to its use.

This model permits us to:

- Compare the opinions of designers, investors, residents and any possible actor on a building.
- Identify divergences and convergences of the different opinions.
- Determine design principles applicable to other projects.

Professor Stephane Hanrot explains that 'the evaluation of the architectural quality can only be relative to the points of actor's view (architects and others)' (Hanrot 2005). This architectural quality is evaluated through several points of view: cultural, aesthetic, use, geographical, morphological, etc. These qualitative points of actor's view collected from questionnaires are transformed in numerical form by attributing to each appreciation a value, then in the form of averages to realize the interpretations.

The values correspond to the following appreciations: 0 = null, 1 = very low, 2 = low, 3 = average, 4 = good, 5 = very good and 6 = excellent.

Actually, 'the use of the qualitative scale is often easier in an interview and allows the researcher to manage a certain inaccuracy. However, the average calculations that we then operate on these values require numerical transcription' (Hanrot 2005).

The presentation of the results is done in the form of radar diagrams where we can deduce the following syntheses:

Table 2 Information on the houses restored by the Medina's Safeguard Association

Actor	Monument	Construction period	Current function	Date and duration of restoration	Classification as an historical monument
Medina's Safeguard Association	Dar Lasram	XVIIIs	Administration of the Medina's Safeguard Association	1970–1972 (2 years)	Classified on the 19/10/1992
	Dar Daouletli	XVIIs	Administration of the music association 'Al Rachidi'	1998–1999 (1 year)	Classified on the 19/10/1992
	Dar Ben Achour	XVIIs	Medina of Tunis Library	1982–1983 (1 year) 2003–2005 (2 years)	Not classified
	Dar El Mourabbi	XIXs	Youth Hostel	1988–1990 (2 years) 1998–1999 (1 year)	Not classified

Table 3 Information on the houses restored by the private investors

Actor	Monument	Construction period	Current function	Date and duration of restoration	Classification as an historical monument
Private investors	Dar El Medina (Dar Belhouane)	XVIIIs–XIXs	Hotel	2002–2005 (3 years)	Not classified
	Dar Ben Gacem (Dar Anoun)	XVIIIs	Hotel	2007–2011 (4 years)	Not classified
	Dar Traki	XVIIIs	Hotel	2007–2011 (4 years)	Not classified
	"El Ali" restaurant	XVIs	Restaurant	2007–2011 (4 years)	Not classified

- Very good synthesis = excellent + balanced
- Good synthesis = excellent + unbalanced = good + balanced
- Partial synthesis = good + unbalanced to the least = average + unbalanced to the most
- Banal synthesis = average + balanced
- Poor synthesis = average + unbalanced to the least = poor + balanced
- Low synthesis = poor + unbalanced to the most = null + unbalanced to the most
- Very low synthesis = null + balanced (Hanrot 1999).

2.2.2 Adaptation of the Model for Analysis, Theory and Architectural Experimentation

Our work consists of the evaluation of the degree of application of the good restoration principles in the various actor's interventions in the Medina of Tunis's residences. An adaptation is needed for the Model for Analysis, Theory and Architectural Experimentation.

Indeed, the corpus includes restored houses not new buildings as in the model. The aspects to be analysed are the common principles of the international charters signed by Tunisia in place of the different points of view mentioned in the model (cultural, aesthetics, usage, geographical, morphological…)

Concerned Population

The population interviewed in this work includes:

- The professionals of the National Heritage Institute and the Medina's Safeguard Association who have sufficient knowledge and who intervened on the restored houses of the corpus.
- Users of the restored houses of the corpus.

We interviewed for each home between eight and fifteen professionals according to their availability and three users at least.

Scale of Value

We used Likert's five-choice answer scale. The value of 3 is considered as the average.

The value and appreciation scale is as follows:

1 = Very low (0%), 2 = Low (25%), 3 = Medium (50%), 4 = Good (75%), 5 = Very good (100%)

Evaluation Criteria

Tunisia is one of the countries that have ratified the World Heritage Convention and whose experts participated in the drafting of international charters, such as the Venice Charter in 1964. For this, actors must respect the general principles

of good restoration and authenticity indicated in the various charters.

The charters that interest our research and that include the principles of good restoration are:

- Athens Charter for the Restoration of Historic Monuments—Athens Conference, 21–30 October 1931.
- International Charter for the Conservation and Restoration of Monuments and Sites—The Venice Charter—1964.
- Charter for the Conservation of Historic Towns and Urban Areas—The Washington Charter—1987.
- The Nara Document on Authenticity—Japan—1994.
- International Cultural Tourism Charter—Managing Tourism at Places of Heritage Significance—Mexico—1999.
- Charter on the Built Vernacular Heritage—Mexico—1999.
- ICOMOS Charter—Principles for the Analysis, Conservation and Structural Restoration of Architectural Heritage—Zimbabwe—2003.
- ICOMOS Charter on the Interpretation and Presentation of Cultural Heritage Sites—Canada—2008.

From these charters, we have identified the following principles:

1. Degree of intervention
   1.1. Regular and permanent maintenance
   1.2. Minimal intervention
2. Respect of historical and aesthetic values
   2.1. Respect for historical values
   2.2. Respect of aesthetic values
   2.3. Respect for the evolution of the monument in time (respect for historical and aesthetic stratifications)
3. Respect for typology
   3.1. Respect for the typology of plans (respect for the same spatial organization before and after intervention)
   3.2. Respect of the typology of the facades (respect of the same organization of doors, windows and decor before and after intervention)
4. Degree of restitution
   4.1. Restitution of plans, walls and roofs
   4.2. Restitution of facades and decor
5. Use of modern materials
   5.1. Use of modern techniques and materials
   5.2. Harmonious integration of modern materials
   5.3. Physicochemical compatibility (judicious choice of intervention materials)
6. Reversibility
   6.1. Possibility of returning to the project before intervention
   6.2. Visibility: distinction between new and old materials
7. Durability
   7.1. Durability and stability
   7.2. Possibility of future interventions.
8. Functional compatibility
   8.1. Respect of the new function for the historical and artistic character
   8.2. Respect of the new function for the typology of the monument
9. Degree of harmony in the equipment refurbishment
   9.1. Harmonious electricity refurbishment
   9.2. Harmonious plumbing refurbishment
   9.3. Harmonious heating and air-conditioning refurbishment
   9.4. Harmonious fire safety refurbishment

We reformulated these principles as questions that we incorporated into a questionnaire that was presented to the concerned population.

Questionnaire

See Table 4.

Method of Results Interpretation

After collecting the questionnaires, we interviewed, for each residence, between eight and fifteen professionals according to their availability and at least three users. We have matched the qualitative evaluation with the corresponding values. We have calculated the evaluation average of professionals and users for each home of each actor.

For each house, in order to be able to measure the degree of respect for the principles of good restoration and authenticity, first, we checked the homogeneity of the opinions of users and professionals through the standard deviation[3], to check whether the visible differences are significant or not.

The standard deviation is high when the dispersion is big and tends towards the average which is 3 in our research. In this case, the opinions of users and professionals are divergent and heterogeneous. The standard deviation is low when the dispersion is small and tends towards 0. In this case, the opinions of users and professionals are convergent and homogeneous. In the case where there is a considerable standard deviation and the opinions of users and professionals are heterogeneous, we measure the respective degree of good restoration principles of each one separately. If the standard deviation is low, so the opinions of users and professionals are homogeneous. In this case, we use the

[3]Standard deviation is a statistical function that measures the dispersion of notes around their average. It is calculated by the software EXCEL by the formula STDEV. The formulae is: $\sqrt{\frac{1}{n}\sum_i (x_i - \bar{x})^2}$ with $\bar{x} = \frac{1}{n}\sum_i x_i$ the arithmetic average.

Table 4 Questionnaire of the restoration principles presented to professionals and users for each house of the corpus

N	Questions	Evaluation					Notes
		Very low	Low	Medium	Good	Very good	
1	*Degree of intervention*						
1.1	Is there regular and permanent maintenance on the monument?						
1.2	Was the restoration intervention minimal?						
2	*Respect of historical and aesthetic values*						
2.1	Is there respect for historical values in the restoration project?						
2.2	Is there respect for aesthetic values in the restoration project?						
2.3	Is there a respect for the evolution of the monument (respect for historical and aesthetic stratifications)?						
3	*Respect of typology*						
3.1	Is there respect for the plans typology? (respect for the same spatial organization before and after intervention)						
3.2	Is there a respect for the facades typology? (respect of the same organization of doors, windows and decor before and after intervention)						
4	*Degree of restitution*						
4.1	Is there a restitution of plans, walls and roofs?						
4.2	Is there a restitution of facades and decor?						
5	*Use of modern materials*						
5.1	Is there a use of modern techniques and materials?						
5.2	Are modern materials integrated harmoniously?						
5.3	Is there a physicochemical compatibility between new and old materials? (Judicious choice of intervention materials)						
6	*Reversibility*						
6.1	Did the project, as it was conceived and realized, permit to return to the initial shape before intervention?						
6.2	Was the principle of visibility used: the distinction between new and old materials?						
7	*Durability*						
7.1	Is the operation sustainable and stable?						
7.2	Are there possibilities to future interventions?						
8	*Functional compatibility*						
8.1	Did the new function respect the historical and artistic character of the monument?						
8.2	Did the spatial organization of the monument have been respected after the integration of the new function?						
9	*Degree of harmony in the equipment refurbishment*						
9.1	Has the refurbishment of the electricity been harmonious with the historical and aesthetic aspect of the monument?						
9.2	Has the refurbishment of the plumbing been harmonious with the historical and aesthetic aspect of the monument?						
9.3	Has the refurbishment of the heating and air-conditioning been harmonious with the historical and aesthetic aspect of the monument?						
9.4	Has the refurbishment of the fire safety been harmonious with the historical and aesthetic aspect of the monument?						

average of the two evaluations which generates a final radial schema, which will be interpreted according to the architectural synthesis of the Model for Analysis, Theory and Architectural Experimentation.

Then, based on the averages of user and professional evaluations, we were able to construct the radial schema that reveals the specificities of the restoration of each residence. After that, we identified the percentage of the principles respect for each house based on the average of all the criteria and the following formulae:

The average is calculated based on the intervals of the scale of values:

1 = 0%, 2 = 25%, 3 = 50%, 4 = 75%, 5 = 100%.

If, for example, the value found is 3.7, which is in the interval between 3 and 4, therefore between 50% and 75%, the calculation will be as follows: [(3.7 * 0.5)/3 + (3.7 * 0.75)/4]/2 = 0.66. So, in this case, the principles were respected at 66%.

After collecting the results of each home, we grouped them by actor. We calculated the evaluations average of the four houses for each actor, which allowed us to identify their radial schema. We superimposed the three respective radial schemas to compare their specificities. Then, from the specificities of each principle of each actor, we determined their respective percentages. Finally, we have identified the percentages of the respect degree of the good restoration principles for each actor and we proceeded to the classification.

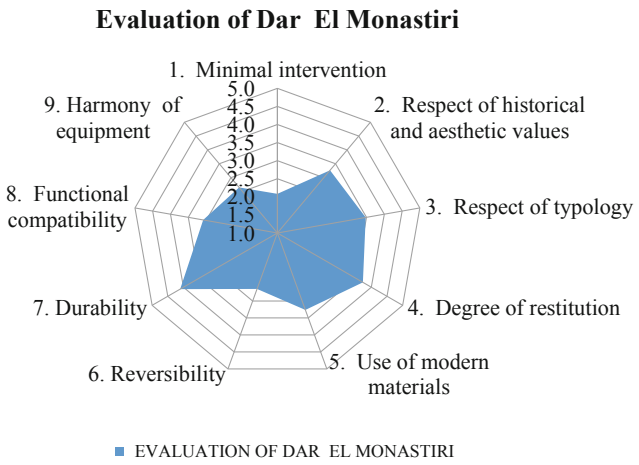

Fig. 14 Radial schema of Dar El Monastiri: poor synthesis = average + unbalanced to the least

3 Results

We present, in this part, for the National Heritage Institute, the detailed results of one of its restored houses as a sample and then we present its restoration characteristics. Then, we present restoration characteristics of the Medina's Safeguard Association and the private investors. Finally, we present the synthesis of the three actors.

3.1 National Heritage Institute Restorations

3.1.1 Restoration Evaluation of Dar El Monastiri

See Fig. 14, Table 5.

3.1.2 Characteristics of the National Heritage Institute Restorations

See Fig. 15, Tables 6 and 7.

3.2 Characteristics of the Medina's Safeguard Association Restorations

See Fig. 16, Tables 8 and 9.

3.3 Characteristics of the Private Investors' Restorations

See Fig. 17, Tables 10 and 11)

3.4 Synthesis of the Actors' Restorations

See Fig. 18, Tables 12, 13 and 14.

4 Discussion

We present in this part the classification of the three actors' restorations, their characteristics and the general recommendations for any intervention.

4.1 The Medina's Safeguard Association and the Private Investors More Respectful for the Principles Than the National Heritage Institute

From the results of the percentages classification of good restorations principles respect, we have the following syntheses according to the adaptation of the Model for Analysis, Theory and Architectural Experimentation (Table 15).

The Medina's Safeguard Association respects the principles of good restoration and authenticity, with a percentage of 70% and is placed in first position. It is the most respectful actor of the principles of good restoration. Private investors are in second place with 65%, which is a medium respect, but which tends towards the good. The National Heritage Institute is in last position, with an average respect of 59% of principle respect of good restoration and authenticity.

Table 5 Questionnaire results and medium percentage for Dar El Monastiri

Principles	Users evaluation of Dar El Monastiri	Professionals evaluation of Dar El Monastiri	Standard deviation	Standard deviation evaluation	Evaluation of Dar El Monastiri
1. Minimal intervention	2.17	2.00	0.12	Standard deviation tends towards 0 → homogeneous opinions between users and professionals	2.08
2. Respect of historical and aesthetic values	3.78	2.75	0.73		3.26
3. Respect of typology	3.67	3.29	0.27		3.48
4. Degree of restitution	4.00	3.46	0.38		3.73
5. Use of modern materials	3.67	2.86	0.57		3.26
6. Reversibility	3.33	1.96	0.97		2.65
7. Durability	4.17	4.04	0.09		4.10
8. Functional compatibility	2.83	3.33	0.35		3.08
9. Harmony of equipment	3.17	2.13	0.74		2.65
Value of the evaluation average of Dar El Monastiri					3.14

3.14 is in the interval between 3 and 4, therefore between 50 and 75%, the calculation will be as follows:
[(3.14 *0.50)/3 + (3.14 * 0.75)/4]/2 = 0.55
The principles of good restoration and authenticity were respected at 55%: medium respect

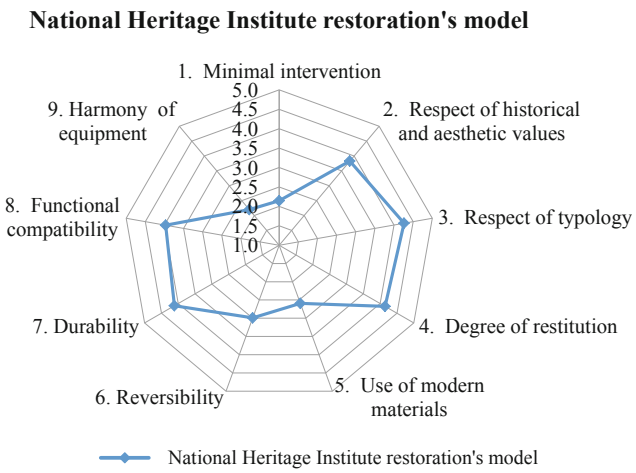

Fig. 15 Radial schema of the National Heritage Institute restorations: Partial synthesis = good + unbalanced to the least

Although it represents the official institution, the National Heritage Institute is the last actor respecting the principles. This result is disturbing, for that we will analyse the characteristics of different actors' restorations to understand their strengths and weaknesses which will permit to emit recommendations that fill the problems in public restorations especially.

4.2 Actors' Restoration Characteristics

According to the following radar schema, the Medina's Safeguard Association restorations presents a good synthesis = excellent + unbalanced. The private restorations presents a good synthesis = good + balanced. The National Heritage Institute restorations present a partial synthesis = good + unbalanced to the least.

According to the superimposition of the three radar schemas of the three actors, we can say that they have given a good interest to historical and aesthetic values, restitution, durability and functional compatibility. The Medina's Safeguard Association and the National Heritage Institute respect the typology more than the private investors. The Medina's Safeguard Association and the private investors use modern techniques and materials better than the National Heritage Institute. The Medina's Safeguard Association respects reversibility more than the other two actors.

Table 6 Evaluation of the National Heritage Institute restorations

Principles	Evaluation of Dar El Monastiri	Evaluation of Dar El Jaziri	Evaluation of Dar Othman	Evaluation of Dar El Haddad	Standard deviation	Standard deviation evaluation	Evaluation of the national heritage institute restorations
1. Minimal intervention	2.08	2.30	1.86	2.34	0.22	Standard deviation tends towards 0 → homogeneous opinions	2.15
2. Respect of historical and aesthetic values	3.26	3.99	4.08	3.98	0.38		3.83
3. Respect of typology	3.48	4.53	4.57	4.48	0.52		4.26
4. Degree of restitution	3.73	4.13	4.43	4.30	0.30		4.15
5. Use of modern materials	3.26	2.41	1.82	2.88	0.62		2.59
6. Reversibility	2.65	3.35	3.20	2.75	0.34		2.99
7. Durability	4.10	4.34	3.90	4.11	0.18		4.11
8. Functional compatibility	3.08	4.66	4.37	3.76	0.70		3.97
9. Harmony of equipment	2.65	1.55	2.02	2.57	0.51		2.20

Table 7 Medium respect of principles for the National Heritage Institute restorations

Classification by percentage	Residences	Principles respect percentage (%)
1	Dar El Haddad	61
1	Dar El Jaziri	61
3	Dar Othman	59
4	Dar El Monastiri	55
Global percentage for the National Heritage Institute restorations		59%: medium respect of principles

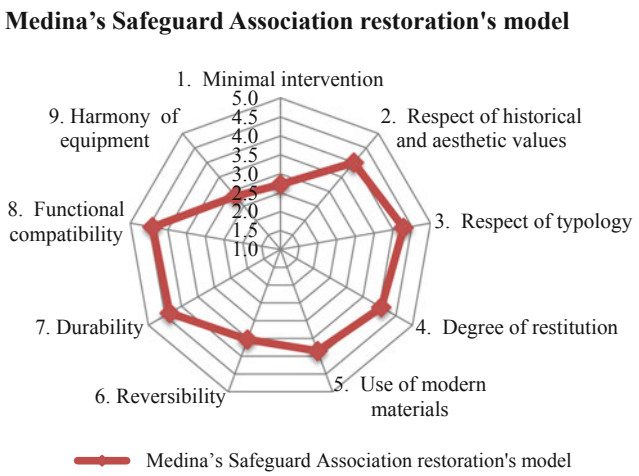

Fig. 16 Radial schema of the Medina's Safeguard Association restorations: good synthesis = excellent + unbalanced

The private investors respect the harmony in the refurbishment of equipment and minimal restoration, more than the other two actors (Fig. 19).

We have, according to Table 16, the respect percentage of each actor for each principle.

The Medina's Safeguard Association is at the top in terms of the number of principles with a maximum percentage. In fact, it responds the first to six principles, the private investors responds the first to two principles and the National Heritage Institute responds to a single principle in the first place.

The Medina's Safeguard Association is the most interesting, with good respect, to the functional compatibility, durability, respect for the typology, historical and aesthetic values. The use of modern techniques, materials and reversibility was moderately respected with a percentage tending towards the good.

Table 8 Evaluation of the Medina's Safeguard Association restorations

Principles	Evaluation of Dar Lasram	Evaluation of Dar Daouletli	Evaluation of Dar Ben Achour	Evaluation of Dar El Mourabbi	Standard deviation	Standard deviation evaluation	Evaluation of the national heritage institute restorations
1. Minimal intervention	3.36	2.21	2.05	3.25	0.68	Standard deviation tends towards 0 → homogeneous opinions	**2.72**
2. Respect of historical and aesthetic values	4.45	4.62	3.82	3.10	0.69		**4.00**
3. Respect of typology	4.51	4.73	4.45	3.44	0.57		**4.28**
4. Degree of restitution	4.35	4.55	3.92	3.41	0.51		**4.06**
5. Use of modern materials	4.17	4.15	3.50	3.58	0.36		**3.85**
6. Reversibility	3.70	4.23	3.38	2.81	0.59		**3.53**
7. Durability	4.46	4.64	4.45	3.88	0.33		**4.36**
8. Functional compatibility	4.70	4.62	4.60	3.72	0.46		**4.41**
9. Harmony of equipment	3.74	2.90	2.25	2.45	0.66		**2.84**

Table 9 Good respect of principles for the Medina's Safeguard Association restorations

Classification by percentage	Residences	Principles respect percentage (%)
1	Dar Lasram	81
2	Dar Daouletli	75
3	Dar Ben Achour	64
4	Dar El Mourabbi	58
Global percentage for the Medina's Safeguard Association restorations		70%: good respect of principles

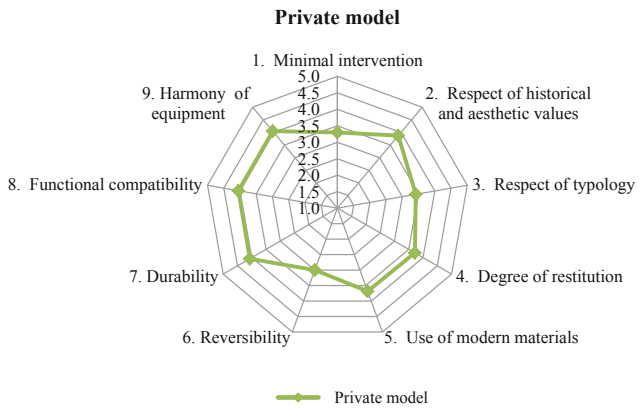

Fig. 17 Radial schema of the private restorations: good synthesis = good + balanced

The Medina's Safeguard Association has respected most of the international charter principles, it is interested in functional adaptation, with respect for historical, aesthetic and typological values while innovating with modern techniques and reversible materials.

It has an application of 70% in respect of authenticity and good restoration principles of the international charters. By respecting more the criteria, it can improve its restorations, especially in terms of equipment refurbishment. It reconciles history and innovation in its restorations.

The private investors respect better than the other actors, the harmonious equipment refurbishment, because of the importance of the comfort for the users. The minimal intervention principle is also important because it is related to the budget; when the intervention is minimal, the budget is lesser so the restoration will be more profitable.

Table 10 Evaluation of the private restorations

Principles	Evaluation of Dar El Medina	Evaluation of Dar Ben Gacem	Evaluation of Traki	Evaluation of the restaurant "El Ali"	Standard deviation	Standard deviation evaluation	Evaluation of the private restorations
1. Minimal intervention	3.75	3.27	2.94	3.24	0.34	Standard deviation tends towards 0 → homogeneous opinions	**3.30**
2. Respect of historical and aesthetic values	3.72	4.15	4.11	3.51	0.31		**3.87**
3. Respect of typology	3.40	4.23	2.69	3.35	0.63		**3.42**
4. Degree of restitution	3.81	4.33	3.76	2.95	0.57		**3.71**
5. Use of modern materials	4.01	2.97	4.22	3.53	0.56		**3.68**
6. Reversibility	2.75	3.12	3.09	3.04	0.17		**3.00**
7. Durability	4.10	3.88	4.19	4.09	0.13		**4.07**
8. Functional compatibility	4.17	4.23	4.17	3.64	0.28		**4.05**
9. Harmony of equipment	4.20	4.49	4.18	3.34	0.50		**4.05**

Table 11 Medium respect, tending to the most, of principles for private restorations

Classification by percentage	Residences	Principles respect percentage (%)
1	Dar Ben Gacem	68
2	Dar El Medina	67
3	Dar Traki	66
4	Restaurant "El Ali"	60
Global percentage for private restorations		65%: medium respect, tending to the most, of principles

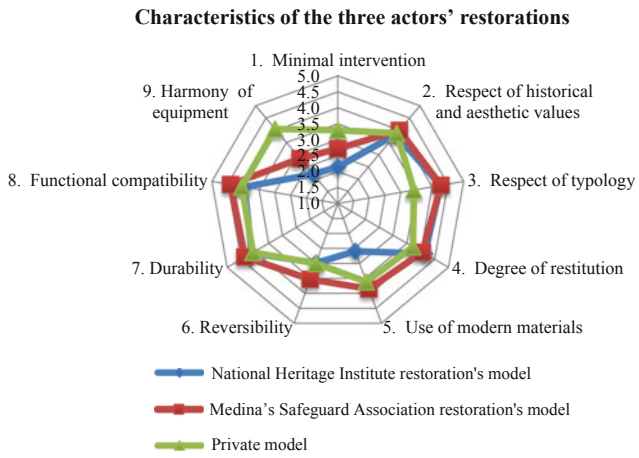

Fig. 18 Radial schema of the characteristics of the three actors' restorations

Durability is very important also. Moreover, the functional compatibility is equivalent to the equipment refurbishment, because it represents a non-separable set.

The medium principles tending to the good include respect for historical and aesthetic values, use of modern materials and restitution. Indeed, the adaptation to the new function has not prevented the private investors to respect the historical and aesthetic values, with a balance made with the use of modern materials. The moderately respected criteria are typology and reversibility because of different constraints.

The private investors did not neglect the respect of historical and aesthetic values, but on the contrary, they respected them and they integrated the function and the comfort equipment with a minimum of intervention. They reconcile the ancient image and comfort in their restorations.

Table 12 Models of the three actors

Principles	National Heritage Institute restoration's model	Medina's Safeguard Association restoration's model	Private model
1. Minimal intervention	2.15	2.72	3.30
2. Respect of historical and aesthetic values	3.83	4.00	3.87
3. Respect of typology	4.26	4.28	3.42
4. Degree of restitution	4.15	4.06	3.71
5. Use of modern materials	2.59	3.85	3.61
6. Reversibility	2.99	3.53	3.00
7. Durability	4.11	4.36	4.07
8. Functional compatibility	3.97	4.41	4.05
9. Harmony of equipment	2.20	2.84	4.05

Table 13 Maximum percentages of principles by actor

Actor	1. Minimal intervention (%)	2. Respect of historical and aesthetic values (%)	3. Respect of typology (%)	4. Degree of restitution (%)	5. Use of modern materials (%)	6.Reversibility (%)	7. Durability	8. Functional compatibility (%)	9. Harmony of equipment (%)
Medina's Safeguard Association	40	**75**	**83**	79	**68**	**63**	**84**	**85**	41
Private investors	**56**	67	59	64	64	50	77	76	**76**
National Heritage Institute	31	68	82	**80**	38	50	80	70	32

Table 14 Actors' classification by respect percentages of principles

Classification by percentage	Actor	Principles respect percentage
1	Medina's Safeguard Association	70%: good respect of principles
2	Private investors	65%: medium respect, tending to the most, of principles
3	National Heritage Institute	59%: medium respect of principles

Table 15 Actors' classification by respect percentages of principles

Classification by percentage	Actor	Principles respect percentage
1	Medina's Safeguard Association	70%: good respect of principles
2	Private investors	65%: medium respect, tending to the most, of principles
3	National Heritage Institute	59%: medium respect of principles

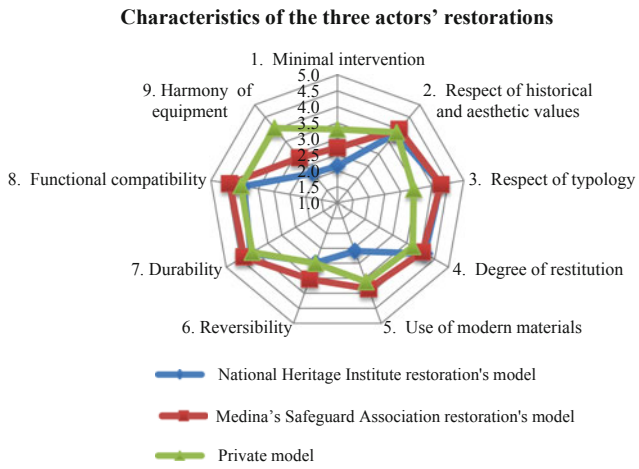

Fig. 19 Radial schema of the characteristics of the three actors' restorations

The National Heritage Institute exceeds the Medina's Safeguard Association and the private investors in the degree of restitution. It reconstructs the parts in ruins identically to the ancient ones without clarification.

Restitution is not a recommended principle in international charters because it generates historical and artistic falseness. With the same percentage of restitution, we find the principle of durability. The typology is well respected while historical and aesthetic values and functionality are moderately respected tending towards good. The use of modern materials, the equipment refurbishment and the minimal restoration are weakly applied.

The restoration characteristics of the National Heritage Institute are the restitution, the durability and the respect of the typology, which does not represent a complete respect of the charter principles. It is based on restitution in search of the original image, which does not correspond to the recommendations of the international charters and the principles of the good restoration.

4.3 Recommendations

We will present recommendations derived from the principles and general recommendations.

4.3.1 Principal Recommendations

Principle 1: Minimal Intervention

To promote minimal restoration and preserve authenticity, it is recommended to concentrate the restoration on a part of the building to preserve the rest with a maximum without intervention and to use the concept of zoning.

For example, in Dar El Medina, as we see in the plan below, we find a concentration of the major works in the service area unlike the principal part which is kept with the minimum intervention (Fig. 20).

Principle 2: Respect of Historical and Aesthetic Values

To promote respect for historical and aesthetic values and authenticity, it is recommended to:

- Indicate the historical evolution of the monument through epigraphs, like the epigraph exposed in Dar Daouletli which indicates that the residence included the National Printing Office in 1898.
- Respect evolution of the project without returning to the initial form, but rather restore it as it is (Fig. 21).

Principle 3: Respect of Typology

To promote respect for the typology, it is recommended to:

- Respect the same spatial organization.
- Add reversible architectural elements, in case of functional needs.
- Respect the organization of the facades; do not change the organization of doors and windows.

Table 16 Maximum percentages of principles by actor

Actor	1. Minimal intervention (%)	2. Respect of historical and aesthetic values (%)	3. Respect of typology (%)	4. Degree of restitution (%)	5. Use of modern materials (%)	6. Reversibility (%)	7. Durability (%)	8. Functional compatibility (%)	9. Harmony of equipment (%)
Medina's Safeguard Association	40	**75**	**83**	79	**68**	**63**	**84**	**85**	41
Private investors	**56**	67	59	64	64	50	77	76	**76**
National Heritage Institute	31	68	82	**80**	38	50	80	70	32

1 : Principal part with a minimum of intervention - 2: Service part with intervention

Fig. 20 Zoning of interventions in the ground floor plan of Dar El Medina (Ben Said, 2016)

Fig. 21 Epigraph in Dar Daouletli indicating that it included the National Printing Office in 1319H/1898 during the reign of Ali Pasha Bey III (author's photograph)

- Respect the organization of the decor; do not add or remove decorative elements.

In Dar Daouletli, all these points have been respected and it is presented in Figs. 22 and 23.

Principle 4: Restitution

To use the advantages of restitution and do not switch to the full restitution not recommended by the international charters, it is desirable to use restitution only in structural reinforcements and avoid the restitution of the decor and all the details, such as the example of Dar Daouletli where the slab was rebuilt with new materials and the false ceiling was simple and not decorated (Figs. 24 and 25).

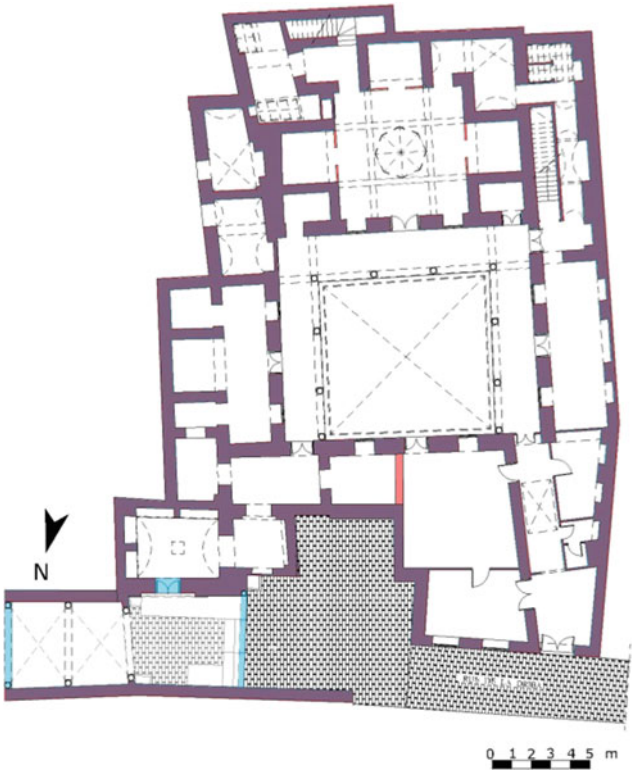

Fig. 22 Plans typology respected in Dar Daouletli (Ben Said 2016)

Fig. 23 Facades typology respected in Dar Daouletli (author's photograph)

Principle 5: Use of Modern Materials

To promote the good use of modern techniques and materials, it is recommended to:

- Differentiate the style of the added elements.
- Integrate simple and neutral elements without trying to reproduce the ancient elements.

Fig. 24 Rebuilt slab of Dar Daouletli (Mouhli et al. 2013)

Fig. 26 Successful addition of an iwan in Dar traki (author's photograph)

Fig. 25 Simple false ceiling in Dar Daouletli (author's photograph)

Fig. 27 Revisited integration of old materials in Dar traki (author's photograph)

- Integrate harmonious materials in terms of shapes, colours, textures and proportions.
- Encourage innovation (Figs. 26 and 27).

Principle 6: Reversibility

To promote reversibility, it is recommended to:

- Generalize the use of reversible materials on the whole monument.
- Vary the nature of reversible materials: steel, wood, glass, etc.
- Insist on the visibility and harmony of reversible materials.

These recommendations were used in Dar Daouletli. The patio was covered by a removable metallic structure and the alcoves were divided by removable wood separations as presented in the photographs (Figs. 28 and 29).

Fig. 28 Removable metallic roofing in Dar Daouletli (author's photograph)

Fig. 29 Removable wood partitions in Dar Daouletli (author's photograph)

Principle 7: Durability

To promote durability, it is recommended to respect both structural and functional aspects by:

- Guaranteeing structural stability.
- Promoting the use of reversible materials in functional adaptation to always permit future interventions.

Principle 8: Functional Compatibility

To promote functional compatibility, it is recommended to:

- Optimize the use of spaces such as the use of half levels.

Fig. 30 Various types of lighting in Dar Ben Gacem (author's photograph)

- Consider the function in the design before the start of the construction work.
- Assign the monument to a function close to its original function.

Principle 9: Harmony in the Equipment Refurbishment

To promote the harmonious integration of equipment, it is recommended to:

- Multiply the ambiances by the variation of the types of lighting, the sanitary accessories, etc.
- Use the most discreet technical solutions possible for heating and air-conditioning.
- Generalize the harmonious integration of all the equipment in all spaces even those of service.

These recommendations were used in Dar Ben Gacem. Different types of lighting were used and the piping was well integrated as presented in the photographs (Figs. 30 and 31).

4.3.2 General Recommendations

Recommendations include practices to avoid and good practice advice.

Practices to Avoid

To ensure a good restoration, it is recommended to avoid:

- Full restitution.
- Non-differentiation of new materials used.

Fig. 31 Integrated equipment in Dar Ben Gacem (author's photograph)

- The non-harmonious use of modern materials.
- Non-harmonious integration of equipment.
- The addition of non-functional spaces.
- The dominance of a single actor in the decision-making.

Good Practice Restorations Advices

To ensure a better application of the good principles restoration and authenticity, it is recommended to:

- Preserve the ancient part of the monument.
- Preserve the organization around the patio.
- Preserve the typology and the historical and aesthetic values.
- Integrate the new function into the existing typology with the minimum of intervention.
- Use additions with modern and reversible materials.
- Add simple spaces, sober and without ornamentation.
- Add spaces with a creative touch.
- Harmoniously integrate the patio roofing, in case of functional need, in terms of shapes and materials.
- Harmoniously integrate all the equipment.
- Illuminate, in case of functional needs, ancient spaces with openings in walls consolidated with visible materials or skylights.
- Organize the archives of the heritage institutions and open them to the public.
- Publish diagnoses and restoration steps by the heritage institutions and the private investors.

5 Conclusion

The Medina's Safeguard Association has respected most of the international charter principles. It is interested in functional adaptation with respect to historical, aesthetic and typological values, while innovating with modern and reversible techniques and materials. It can further improve its restorations, especially in terms of equipment integration by consulting engineers and specialized control offices.

The private investors did not neglect the respect of historical and aesthetic values, but on the contrary, they respected them and integrated the function, the comfort equipment with a minimum of intervention. Private interventions produce good results if they are well supervised by specialized professionals.

The National Heritage Institute applied the restitution and the durability and respected the typology, the functional adaptation and the historical and aesthetic values, but it ignored the use of the modern materials, the reversible interventions, the harmonious integration of equipment and minimal intervention, which does not represent a complete respect for the principles of international charters. The National Heritage Institute, with its historical and archaeological culture, applies conservatism and a resistance to innovation by favouring the restitution and use of ancient materials. If it dominates architectural culture more than historical by involving all actors, it could improve its interventions.

The three actors responsible for restoring the houses in the Medina of Tunis apply three different restoration policies. There is no common policy that unites them. Harmonization of intervention and better consultation of specialists in heritage are essential to preserve the authenticity of residences.

A partnership between the public institution, the association and private investors is desirable. The efficient supervision of private restorations by public institutions is preferable to avoid wrong operations.

It is recommended to involve all professional actors in the decision-making and to ensure coordination between them. It is advisable also to form specialized companies in the heritage to preserve the know-how and the old techniques of construction.

Finally, it is better to incorporate restoration norms into the legislation.

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Preserving the Identity of Traditional Buildings Through Conserving Their Passive Systems

Zainab Murtadhawi

Abstract

In hot and dry climates, traditional buildings needed to respond to the harsh environment and did so by adopting passive systems, such as wind catchers that served to ventilate and lower the indoor temperature. Therefore, to meet the environmental requirements, wind catchers' designs varied in response to the different economic and social influences of each region, thereby contributing to their significant cultural heritage. However, with technological developments, most passive features in traditional buildings were abandoned and replaced by new mechanical systems. An underappreciation for wind catchers' environmental implications led to a disregard for their performance and cultural significance. This paper explores the environmental, social, cultural, and historical values of three types of wind catchers in Kuwait: *wind towers, wind parapets, and wall openings*. Both historical research method and an experimental study using computational fluid dynamics (*CFD*) were used to assess the importance of these features. The analysis was conducted to evaluate wind catchers' historical value and to determine that they have a cultural significance for Kuwait.

Keywords

Kuwait traditional buildings significance • Cultural value • Passive ventilation systems • Wind catchers • Wind tower • Malqaf • Badgir • Bagdir • Wind parapet • Horizontal badgir • Wall openings

Nomenclature

$(x)^{\circ}$	Degree angle
3D	Three dimension
CFD	Computational fluid dynamics
m	Metre
m/s	Metres per second
NCCAL	National Council for Culture, Arts and Letters

1 Introduction

For many centuries, passive techniques and tools were developed in traditional buildings, in response to the climate condition and local materials available, to provide internal comfort (Sharma and Sharma 2013). Traditional buildings have successfully proved their beneficial interaction with and response to environmental forces. However, each region implemented different techniques and designs in their traditional buildings that suited their particular climate and geographical conditions. The climate of the hot and dry region is known for its harsh condition: warm in summer and dry in winter. In Kuwait, the summer temperature reaches 40–50 °C with sharp variation between day and night, along with dusty winds, low humidity, and intense solar radiation (Gut et al. 1993). However, winter brings cold winds and a low rainfall rate (Gut et al. 1993). Therefore, to achieve comfort in the built environment in this climate, it is essential to reduce the extreme heat and dryness. A well-balanced indoor environment should be achieved by adapting to the conditions of both summer and winter, as well as those of day and night. Traditional buildings were designed with technical components that provided passive ventilation and cooling systems.

In the late twentieth century, there has been strong interest in preserving traditional buildings that had previously been altered with new technologies. Wind catchers, in hot and dry climate regions, were one of the passive cooling

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features used to lower indoor temperatures and provide comfort. In Kuwait, wind towers were designed with one north-facing opening through which air would flow from the outdoors to indoor areas passing by wet, thin fabric (Lewcock 1978). This cool air would then be circulated outdoors though courtyard-facing windows. This feature was abandoned and forgotten after it was replaced by modern air-conditioning systems. The disregard and general misunderstanding of wind catchers' environmental impacts led them to being barred and damaged. Today, there are few remaining traditional buildings that contain the different types of wind catchers. After the discovery of oil in the late twentieth century, and during the modernization period, most of these traditional buildings vanished and only few survived with their wind catchers.

The practice of preserving and conserving historical buildings aimed to protect ancient buildings and monuments from new architectural and technological developments. It mainly involved the restoration and preservation of buildings' structure, form, and fabrics. Not much attention was carried on preserving the use of building's passive systems. Therefore, this paper aims to assess the implication of passive systems, such as wind catchers in the remaining traditional Kuwaiti buildings, and to promote their use. In order to emphasize their significance, it is essential to understand the heritage value of passive systems in traditional buildings, the value of wind catchers in Kuwaiti traditional buildings, and the environmental performance of passive systems. The study covers other types of wind catchers, besides wind towers, and highlights their functional performance as well as their historical heritage values. These wind catchers were created in harmony under sociocultural, economic, and environmental constraints and carried on through history.

2 Historical Background

2.1 Passive Systems' Significance

The significance of an historical building's value is primarily related to the lifespan of the building. In the case of traditional buildings, cultural heritage can be significant, not only for the length of its lifespan, but also for its adaptation of natural features and social communities within its urban environment. The urban context and climate conditions are critical for the interpretation of the site and its built heritage integration with its surrounding environment. According to the Charter on the Built Vernacular Heritage (ICOMOS 1999), the heritage value of these buildings is fundamental to their expression of community culture, relationship with their environment, and reflection of the world's diversity. Therefore, traditional heritage is considered a natural way that communities can house themselves in a world experiencing continuous change, while adapting to social constraints (ICOMOS 1999). Traditional buildings represent one form of tangible cultural heritage, since they demonstrate how communities interact with their nature and history to represent their identity and character. These representations can be seen in traditional community urban patterns, building context, and detail integrity.

The key aspect of traditional buildings' significance is the use of passive systems. Traditional buildings are recognized for their remarkable combinations of socio-economic considerations, cultural heritage, and environmental considerations. Passive systems are the features which best represent this combination. The methodology which addressed environmental considerations through the use of these passive systems, developed and implemented under the economic and cultural influences existing at the time, created heritage. Therefore, traditional buildings' passive systems are considered valuable because of their environmental and heritage meanings. During the global industrial revolution, new technologies were invented and replaced the use of passive features in traditional buildings. Wind catchers were one of these features that were replaced by modern air-conditioning systems.

2.2 Kuwait Traditional Buildings

Records regarding the original creation of Kuwait's traditional town form have been dated from the seventeenth through the early twentieth century, before the discovery of oil (Slot 2003). Today, traditional architecture represents the only significant heritage identity of Kuwait's origin. The traditional buildings of Kuwait based on socio-economic considerations, the urban context, and building construction, implemented passive features in response to the hot and arid climate (Al-Nakib 2016; Lewcock 1978). The primary purpose for this integration was to limit elevations in temperature while providing breezes for both outdoor and indoor areas. Similar to other traditional buildings in the Middle East, the passive features used in Kuwait's traditional buildings include the buildings' orientation, high thermal mass envelope, courtyards, shaded areas, and wind catchers. Although other countries in the Middle East adopted similar passive features, the specific design of each feature varies in its details, which affords each country a unique heritage identity.

The significance of traditional buildings in Kuwait should be emphasized, not only for their historical heritage value, but also for their environmental value and the morphology of their passive features. However, most of these traditional buildings, and/or their passive features, are threatened by demolition, poor conservation practices, weak documentation, and misunderstanding or neglect. In response to the

modernization development, little of the traditional architecture in Kuwait has survived (NCCAL 2017). The change in Kuwait Town can be seen clearly in the aerial views taken in 1950, 1967, 1980, and 2002 (Figs. 1, 2, 3, and 4). However, this resulted in the destruction of the traditional heritage and loss of architectural identity. Clearly, the valuable traditional town has been lost except for a few buildings that are considered authentic examples. Most of the remaining traditional buildings were restored and opened to the public as museums while others were reconstructed or preserved from further damage (NCCAL 2017). However, due to the lack of expertise in conservation practices, many details and materials in those traditional buildings were damaged and lost during restoration. Also, for the purpose of achieving current-day acceptable levels of comfort, mechanical systems, such as air-conditioning and lighting, were added. As a result, the main traditional features and evidence of history were damaged or removed by inappropriate conservation practices.

2.3 Wind Catchers

Wind catchers were constructed in various design forms, such as horizontal badgir or panelled parapet, wall openings, wooden screens or Mashrabiya, and the most popular type known as *wind tower* (Lockerbie 2017; Lewcock 1978; Lavafpour and Surat 2011).

Wind tower is a building component formed by an open shaft that raises high to collect a breeze and direct it into an internal environment (Lavafpour and Surat 2011; Battle and McCarthy 1999). This technique was used in 1300 BC in ancient Egyptian architecture, and its use has persisted in a variety of traditional buildings in the Middle East (Battle and McCarthy 1999; Boloorchi and Eghtesadi 2014). It is also known as *Malqaf*, which means *catcher* in the Arabic language (Fathy et al. 1995; Boloorchi and Eghtesadi 2014), while *Badgir* refers to merged Persian words, *bad* meaning *the wind*, and *gir* meaning *trap* (Malone 2012). Researchers recorded different types of wind towers in the Middle East

Fig. 1 Aerial view of Kuwait Town 1950 (Al-Nakib 2016)

Fig. 2 Aerial view of Kuwait Town 1967 (Caton and Ardalan 2010)

Fig. 3 Aerial view of Kuwait Town 1980 (Caton and Ardalan 2010)

Fig. 4 Aerial view of Kuwait Town 2002 (Caton and Ardalan 2010)

with a variety of forms, designs, and openings. However, all of them functioned through a similar mechanism but worked in different wind conditions. Today, wind towers have proved to be an efficient mechanism in ventilating and cooling the internal environment without consuming much energy. Environmental architects continued to develop wind towers as a useful mechanism in modern architectural buildings. Therefore, the wind tower feature, which represents an important historic feature, must be preserved for its valuable environmental impression. However, despite retaining significant value, it seems other wind catcher types were not as ubiquitous as the wind tower.

Wind parapet: is another type of wind catcher and was known as *Wind-Catcher Parapets* as defined by Lewcock (1978), or *Horizontal Badgir* as highlighted by Lockerbie (2017). The parapet is constructed in two vertical panels with an air gap in-between to divert wind downwards. The external panel was typically made of brick or mud while the internal panel was constructed similarly, but with wooden beams for support (Lewcock 1978). The purpose of this type of wind catcher was to ventilate the roof area, where families would gather in the evening or sleep at night (Lockerbie 2017). Moreover, wind parapets were constructed in 1.8 m high to provide the privacy needed in the social culture of the Middle East (Lockerbie 2017). The wind parapet concept was not limited to the roof area. According to Lewcock (1978), *mid-wall wind catchers* [referring to wind parapets] were common features in Bahraini traditional buildings. These features appeared as a row of horizontal recess niches on external walls (Lockerbie 2017). A wooden shutter was provided inside the wind parapet to moderate wind or dust entry to the interior. Although wind parapets were a traditional way of ventilating areas, the combination of construction method and materials used resulted in a unique architectural character for most buildings in the Middle East.

Wall openings: the third type of wind catcher, as called in Qatar *Naqoush Mefataha*, it means *open patterns* (Lockerbie 2017). This type of wind catcher is very similar to the previous example of a wind parapet on a mid-wall, except that the external panel was designed with multi-pattern openings. The openings were carved in various Islamic patterns on a plaster panel approximately 50 mm thick (Lockerbie 2017). The panel was placed with a setback so as to not be sealed off from rain or high wind (Lockerbie 2017). The concept and form of these wall openings do not differ significantly from *Mashrabiya style*. However, the wall opening used as a wind catcher differs from Mashrabiya, not only in regard to material, but also in its placement. The limited documents available show that wall openings were generally placed at high levels in the room to exhaust the warm air at the top (Lockerbie 2017). The character of the multi-geometrical framework in these wall openings added a significant value to the heritage culture of Qatar and other places in the

Middle East. Thus, many of these details vanished due to indifference and misunderstanding of their architectural and historic significance.

3 Methodology

Mixed research methods were used to understand the variables used to assess the significance values of wind catchers in traditional buildings of Kuwait. Specifically, the strategy used combines different qualitative methods supported by a quantitative process. According to the Charter of Built Vernacular Heritage by ICOMOS (1999), the principles of conserving traditional buildings require a full understanding of these buildings' functional, social, and environmental constraints. Therefore, this study primarily focused on historical research methods to explore the social, economic, and cultural phenomena and their influences in the creation of traditional architecture and buildings' passive features in Kuwait. In addition, an experimental study was used to measure environmental impact on passive features' form and design in the traditional buildings of Kuwait. Due to the sensitive condition of historical buildings, researchers attempted to investigate buildings' morphology through experimental studies, including simulation software (Battle and McCarthy 1999). Therefore, the present study was conducted using the CFD (computational fluid dynamics) modelling with interface support of DesignBuilder software. The experimental method aimed to predict natural air movement throughout the structure of wind catchers, measure its impact on air ventilation, and evaluate the design features. Therefore, the external analysis method was selected for this study, in which air movement would be predicted throughout the modelling structure showing the differences in air velocity and pressure from external and internal environments. As per DesignBuilder CFD's limitations in calculating both external and internal analyses, the decision was taken to create the wind catchers' structure as building components to provide the possibility of predicting air movement around the object. For this purpose, three traditional buildings in Kuwait were selected in which each model represented one type of wind catcher: Model (1) wind tower at Beit Al-Sadu, Model (2) wind parapets at Beit Ghaith, and Model (3) wall openings at Koshk Al-Sheikh Mubarak.

4 Results

4.1 Wind Towers in Kuwait

Perhaps the most familiar type of wind catcher is the wind tower, as it is clearly visible atop buildings. Murtadha Ibn Alwan, a Syrian who travelled from Al-Hasa in Saudi Arabia to Kuwait in 1709, recorded in his diary a description of Kuwait's old town in comparison with Al-Hasa as: "*Fifteen days after our departure [from Al-Hasa] we came to a town named Al-Kuwayt, in the diminutive form. It is a sizable town that resembles Al Hasa. To be true, it is smaller, but in its buildings and towers it is it's like …*" (Slot 2003, p. 37). This confirms wind towers were in use since the eighteenth century and served as major indicators of architectural character in Kuwait (Fig. 5).

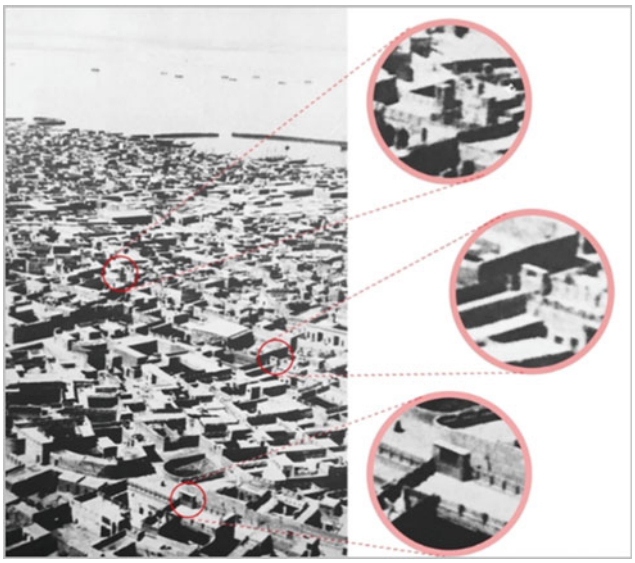

Fig. 5 Kuwait wind towers (Murtadhawi 2017)

In Al-Ghunaim's (1999) book, "*The old Kuwaiti House*", traditional works are described as having a rectangular tower built on top of the roof with a maximum of four openings called *Bagdir*. These towers were linked to floors below through shafts that bring in cold air and ventilate the indoor environment. Al-Ghunaim (1999) suggested that Kuwait's wind towers were originally adopted from Persia. Thus, the design of wind towers was more closely related to the Egyptian and Iraqi wind towers' design, the *Malqaf*. This can be seen in Figs. 6, 7, and 8 that present the similarity of Malqaf design and Kuwait's wind tower. However, other sources have presented wind towers as taller structures with openings on one or more sides, as seen in old Kuwaiti houses in Fig. 9. Due to limited photographic evidence and other sources of documentation, oil paintings by famous Kuwaiti artist Ayoub Hussain Al-Ayoub[1] have been considered as representative. Al-Ayoub's paintings are known for their reflection of old Kuwait's environment and the rich illustration of the old heritage during the 1930s and 1940s (CRSK 2011). Figures 10 and 11 display wind towers with one or more openings on Kuwaiti rooftops.

As an existing example, Beit Al-Sadu has several wind towers, each with an opening facing either north or south and protected by a wooden shutter (Fig. 10). This evidence

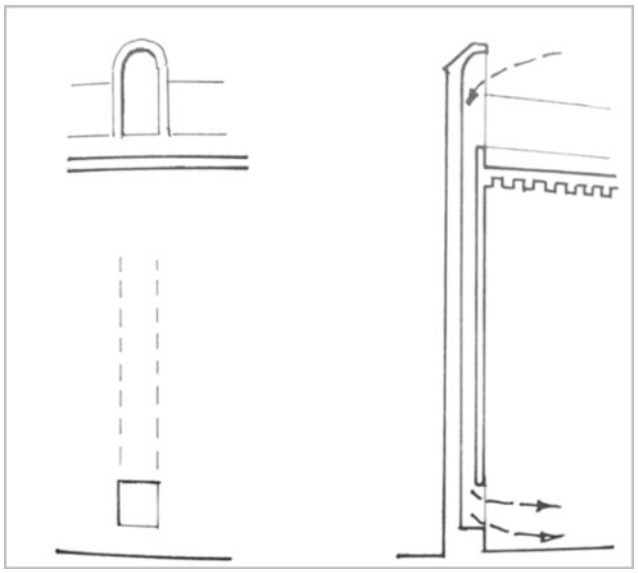

Fig. 6 Wind tower design (Lewcock 1978)

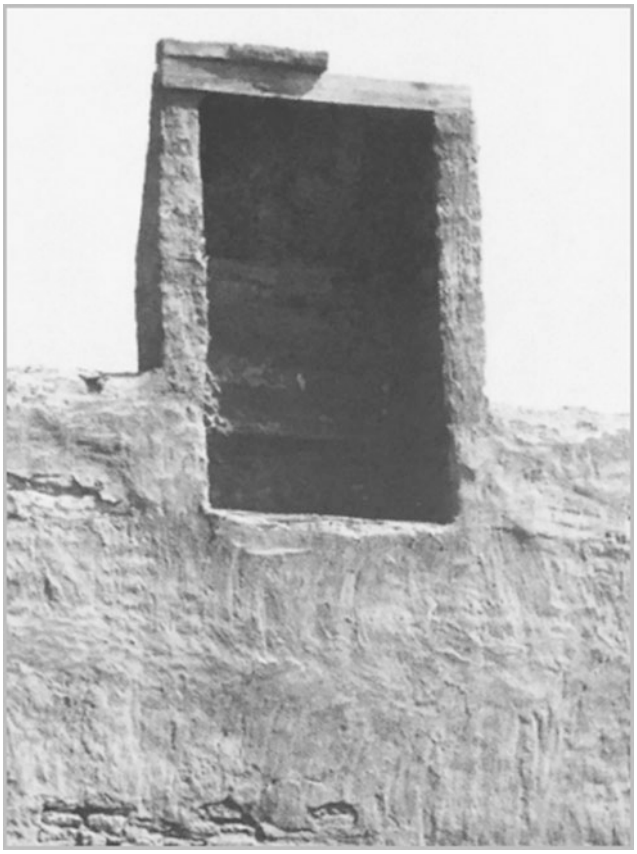

Fig. 7 Wind tower in old Kuwait (Lewcock 1978)

indicates that wind tower design was most likely influenced by Iraqi and Egyptian architecture. Wind towers in other Arab Gulf countries were influenced by Persian

Fig. 8 Wind catcher (Lewcock 1978)

architecture, including the United Arab Emirates, Qatar, and Bahrain. Their popularity supported the cultural identity of the Arab Gulf region and emerged as part of Kuwait's architectural identity. Although the Malqaf wind tower (the Egyptian and Iraqi wind tower) was popular in Kuwait, the Persian tower was used in more modern buildings to represent Kuwait's identity, as in Souq Sharq, although records shown that Sheikh Khazaal, an Arab ruler of Persia, likely brought the Persian wind tower design to Kuwait and incorporated one into Al-Khazaal Palace, built in 1916 (Roy 2013), which is the only evidence for a Persian wind catcher in Kuwait.

Due to limitations of DesignBuilder's capacity in modelling the complete building, a focused zone was selected (Figs. 12 and 13). The zone is considered a typical room facing the women's courtyard. The room has one shaft opening placed in the middle of the north wall which opens to a height no more than 1 m from the ground and leads to

Fig. 9 Wind tower (Lewcock 1978)

Fig. 10 Al-Ayoub's painting (CRSK 2011)

an opening two metres above the roof level. The wind tower is 0.23 m wide, 1.20 m long, and 7 m tall with a flat roof. The top opening is oriented to the south-west direction and functions to exhaust the polluted air from the indoor zone. The CFD analysis was successfully conducted using wind speed of 5.7 m/s from the north-west. The results show the airflow speed and pattern in outdoor and indoor zones. As shown in Fig. 14, on the roof level, airflow from the north-west blows around the wind tower from the opposite side of its opening. Figure 15 demonstrates that low air speed, averaging between 1.4 and 2.1 m/s, is generated inside the zone, and it is circulated in a continuous pattern from the two windows on the south wall. This confirms that the wind tower exhausts warm air from the room, as shown in Fig. 16. It seems that there is a direct relationship between the room's location and the air movement in the courtyard: a cold breeze from the courtyard passes through the windows into the room and then exhausts out through the wind tower. While the wind tower's generated airflow inside the zone would provide some fresh air, the low airflow rate in this zone is insufficient to achieve thermal comfort.

4.2 Wind Parapets

The wind parapet is another type of wind catcher used for cooling air on rooftop common areas. The benefits of a wind parapet were often enjoyed during family gatherings in the evening or while rooftop sleeping on summer nights. According to Al-Ghunaim (1999), in the traditional Kuwait house, the roof parapet was called *Eheya* (Figs. 17 and 18). The parapet feature was common among traditional buildings in the Arab Gulf region and presented a distinctive pattern at the top of buildings: a horizontal frame with vertical shading and recessed lines. Lewcock (1978) presumed that the concept of wind parapets was imported to Kuwait from Bahrain. However, there are few sources that point to the site of wind parapets, original creation. Further, it seems there is lack of awareness regarding the purpose of wind parapets in Kuwait. Few researchers identified the wind parapets as passive cooling features. The physical practice of using wind parapets has been preserved in part by the memories of old men, but this practice is threatened by the chance of the older generation forgetting.

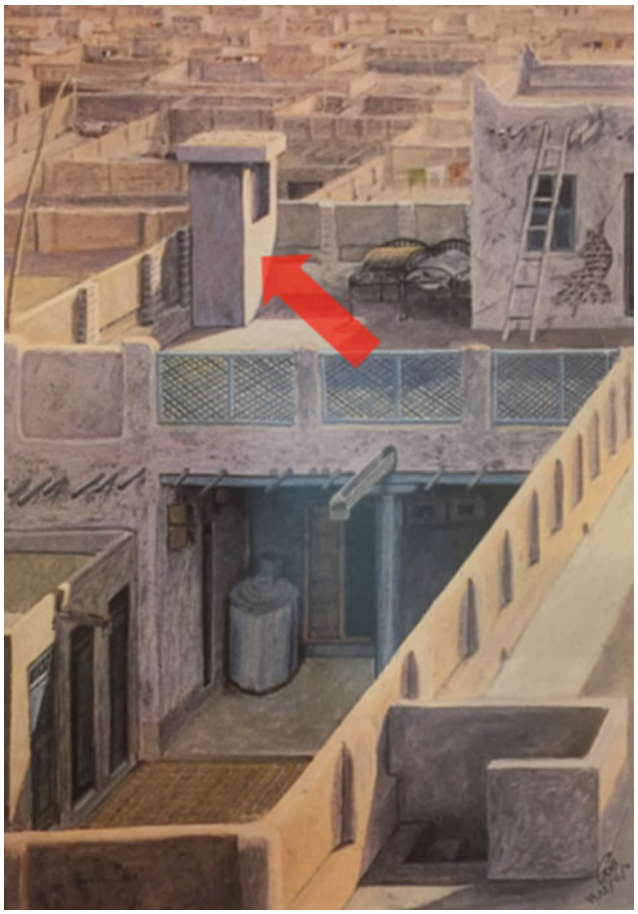

Fig. 11 Wind tower (CRSK 2011)

Nevertheless, Al-Ayoub depicted the traditional rooftop social activities in his paintings. Figure 19 displays one of Al-Ayoub's paintings, including wind parapets on traditional buildings in Kuwait, beds located on the rooftop area, and a man sleeping near the wind parapets. While these paintings provide significant evidence regarding the objective of using wind parapets, evaluating their performance in achieving these objectives is essential. The lack of awareness regarding wind parapets can also be evaluated by examining the restoration practices of the remaining traditional buildings in Kuwait. Specifically, the exposed patterns have been appropriately preserved while structural details were damaged (Figs. 20 and 21). Therefore, wind parapets have been well known for their outward appearance and patterning, without understanding their significant function.

Existing evidence of wall parapets in Kuwait's traditional buildings was limited to the Al-Ghaith house, where a room, located on the roof level, has a wall parapet on each of the four walls. This case was selected to assess the performance of one such wind parapet in the Ghaith house using CFD analysis (Figs. 22 and 23). The roof space on the north side of the building was used as an extra room and gathering area. The results show that wind parapets can enhance air movement in the space. Figures 24 and 25 present the airflow pattern from a north-west wind with a speed between 4.3 and 5.09 m/s into the external roof area causing air circulation with a speed range between 1.45 and 2.18 m/s.

Fig. 12 A plan shows the focus study zone in Beit Al-Sadu (Murtadhawi 2017)

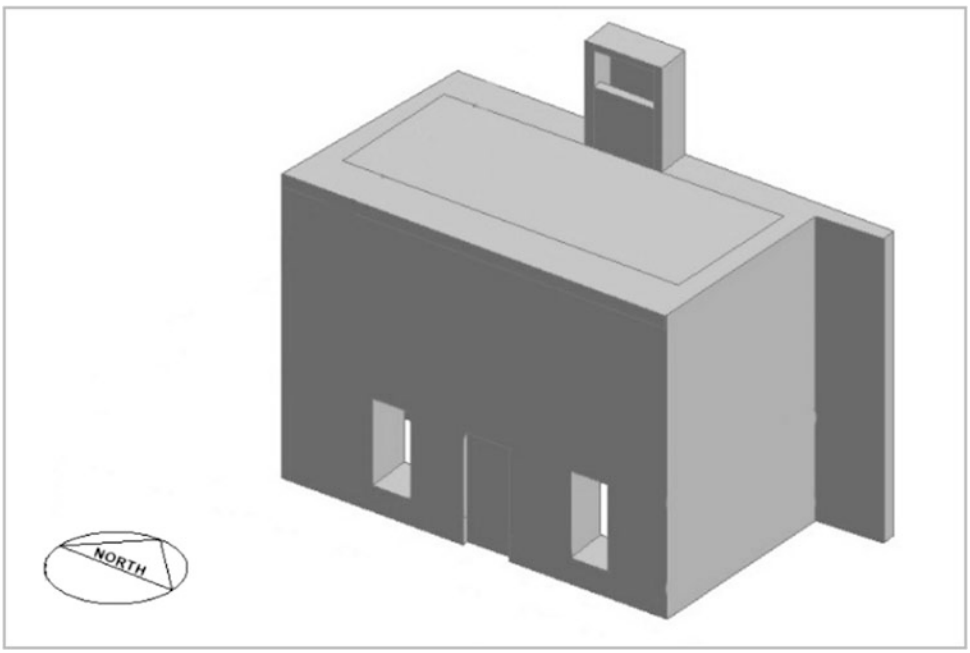

Fig. 13 Model (1) selected zone at Beit Al-Sadu, using DesignBuilder software (Murtadhawi 2017)

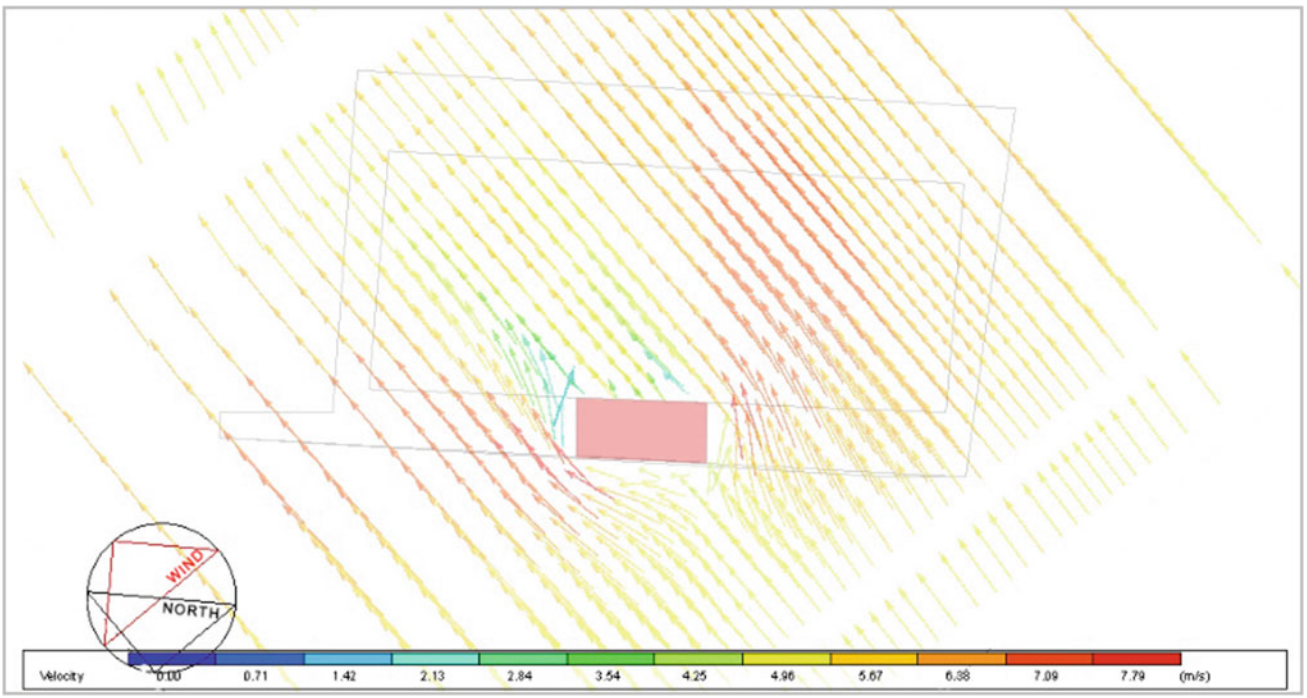

Fig. 14 CFD result showing airflow pattern on the roof level (Murtadhawi 2017)

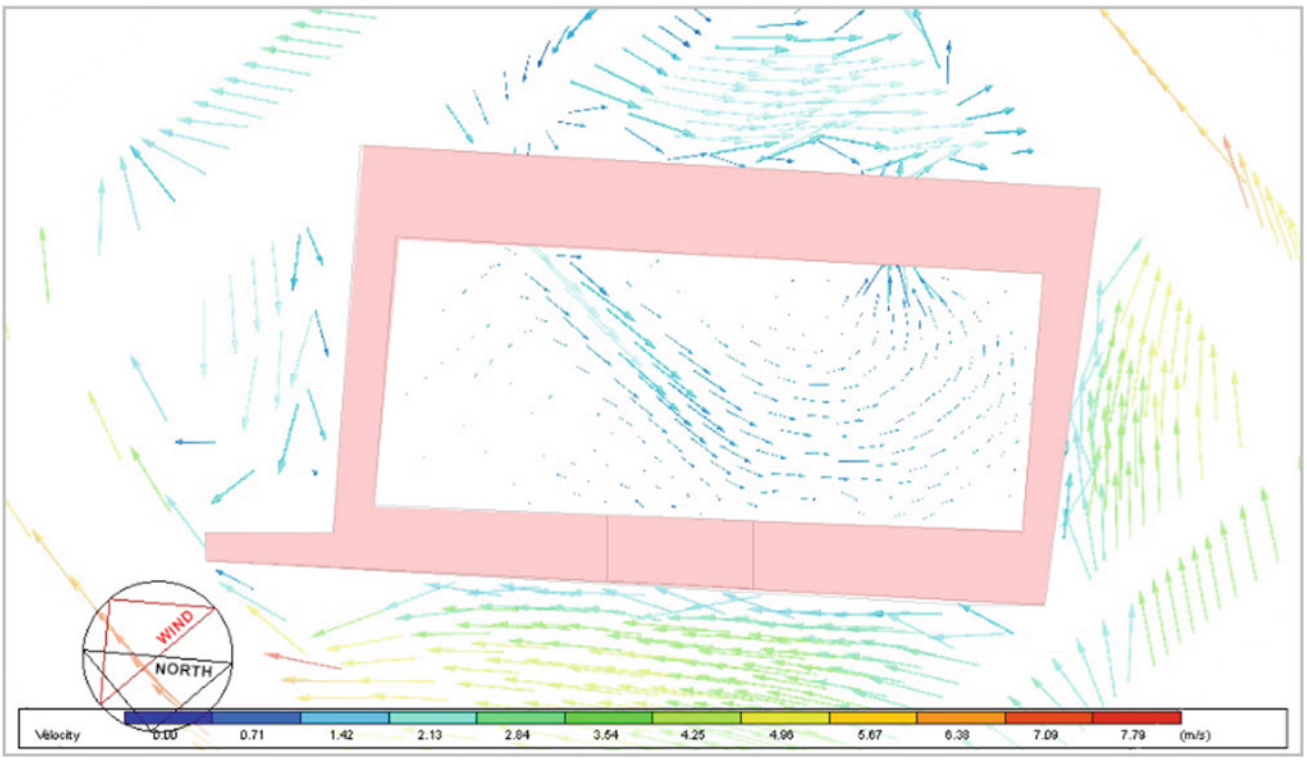

Fig. 15 CFD result showing airflow pattern inside the zone (Murtadhawi 2017)

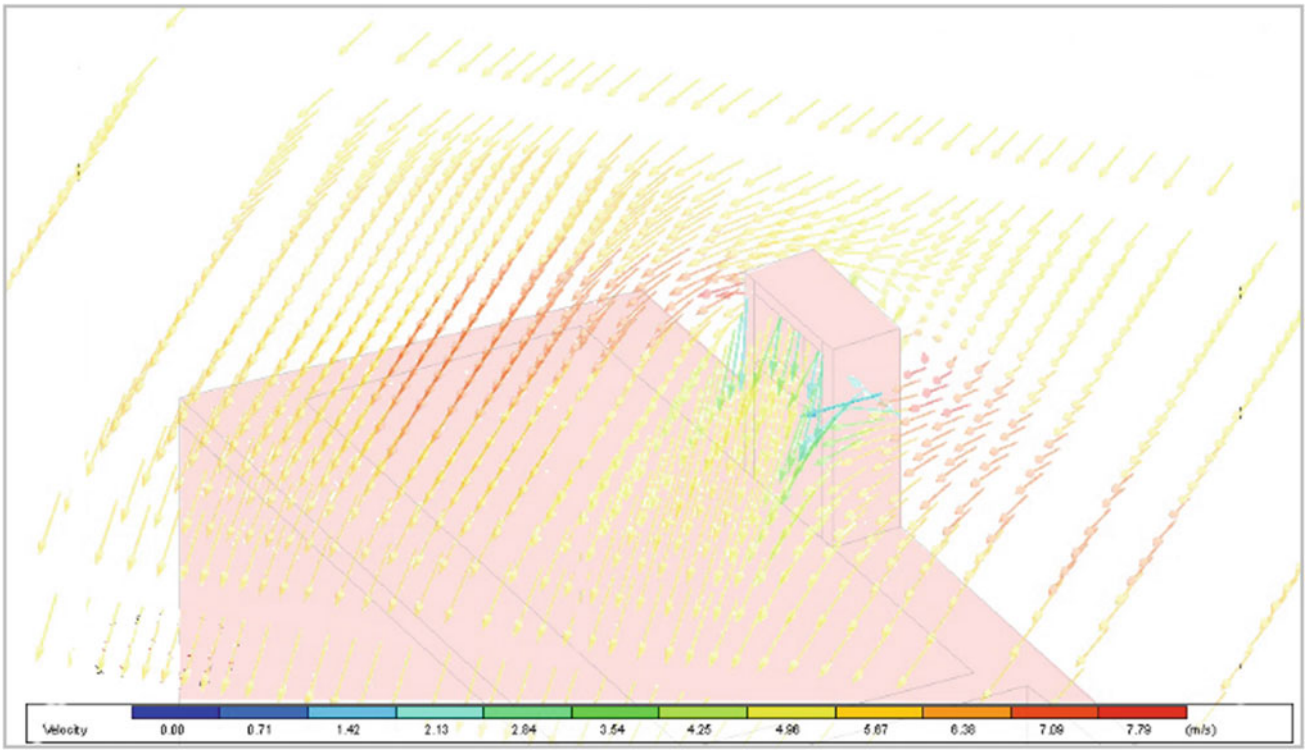

Fig. 16 CFD result showing airflow pattern that exists from wind tower's opening (Murtadhawi 2017)

Fig. 17 Wind parapet (Lewcock 1978)

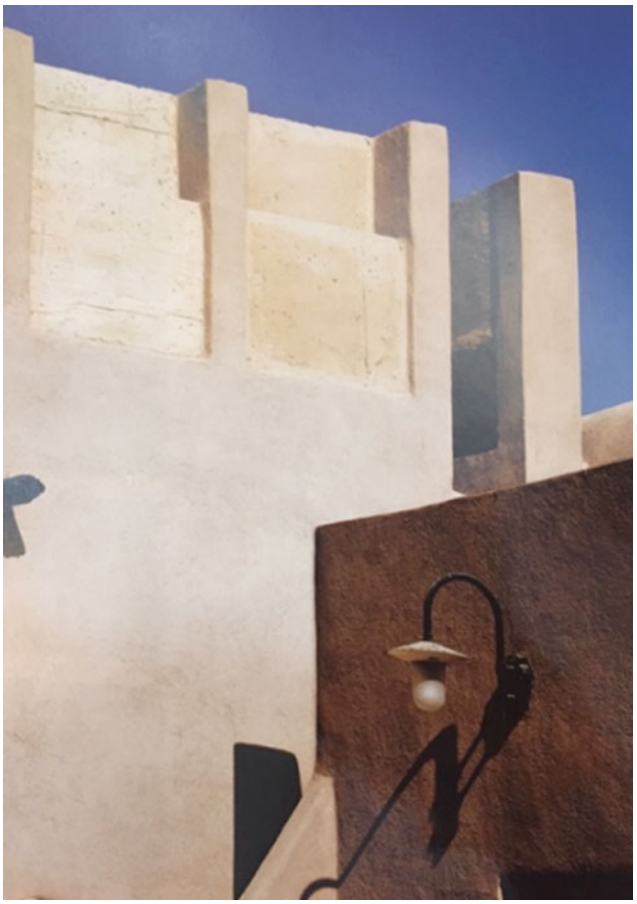

Fig. 18 Wind parapet in Beit Ghaith (NCCAL 2010)

4.3 Wall Openings

The wall opening was popular in Qatar, Bahrain, and United Arab Emirates. In Kuwait, a very limited source can be found for the use of wall openings in the traditional buildings. However, Al-Ayoub illustrated some wall openings in his paintings with different materials using cross-wooden frames, as shown in Figs. 26 and 27. These wall openings were adopted by succeeding generations as a traditional heritage pattern without complete knowledge about their importance in cooling and ventilating environment.

This was only found in Al-Sheikh Mubarak Koshk (Figs. 28 and 29). The wall openings were placed on both north and south elevations to enhance air circulation inside the Koshk (Figs. 30 and 31). The openings are located on the lower side of wooden windows at a height of 0.45 m. It has been suggested that these wall openings were used to ventilate the space by allowing the cold breeze from the north side to penetrate into the Koshk. CFD analysis confirmed these claims. Figure 32 shows the airflow pattern distributed in Koshk Mubarak. Wind from north-west passed through the wall openings on north side of the space with a speed between 2.08 and 4.84 m/s. Airflow would then exit from the south side at a lower speed. Similar to the previous wind catcher types, the CFD analysis indicated that wall openings enhanced the air circulation inside the Koshk and contributed to air turnover.

5 Conclusion

Arising from the way traditional buildings were constructed, they respond well to the climate changes in various mechanisms. Their favourable environmental impact has been

Fig. 19 Painting by Ayoub Al-Ayoub (CRSK 2011)

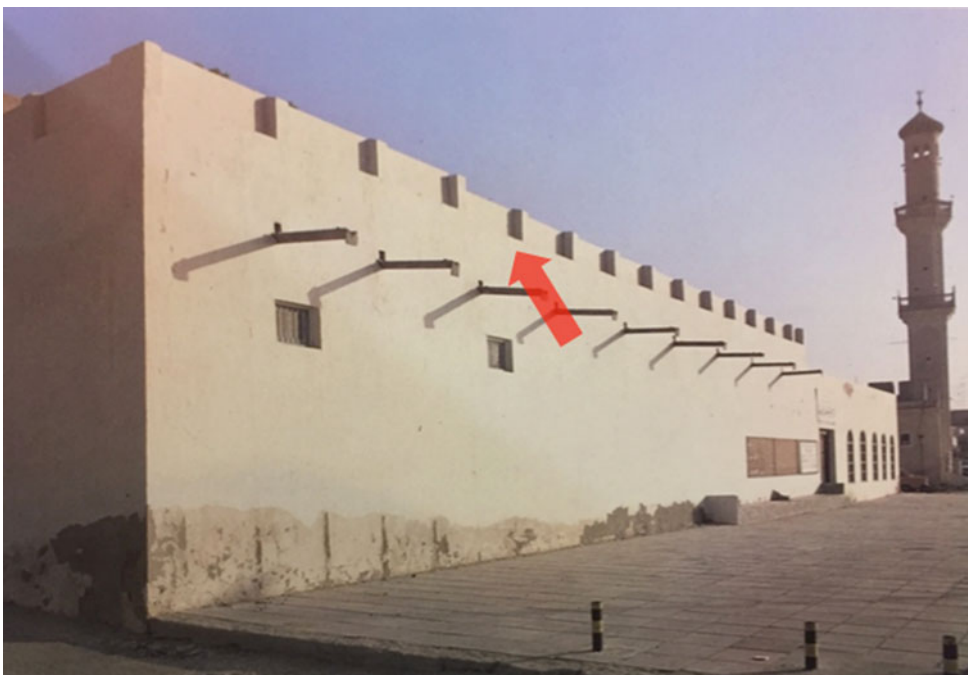

Fig. 20 Wind parapet used in Al-Ghanim house, Kuwait (Lewcock 1978)

attributed to the performance of their passive features. Indeed, appropriate analysis has determined that passive features are the key for making those buildings more comfortable and energy efficient. Efforts to conserve traditional buildings can be considered environmentally sustainable; passive features must be conserved not only for their environmental impacts, but also because of their significant historical and cultural values. It is important to understand passive features' cultural implications and physical morphology in order to determine the most appropriate means of conservation strategy. If passive features are misunderstood, conservation practices may be misapplied and could adversely impact the identity and character of traditional buildings. Therefore, it is recommended to change the

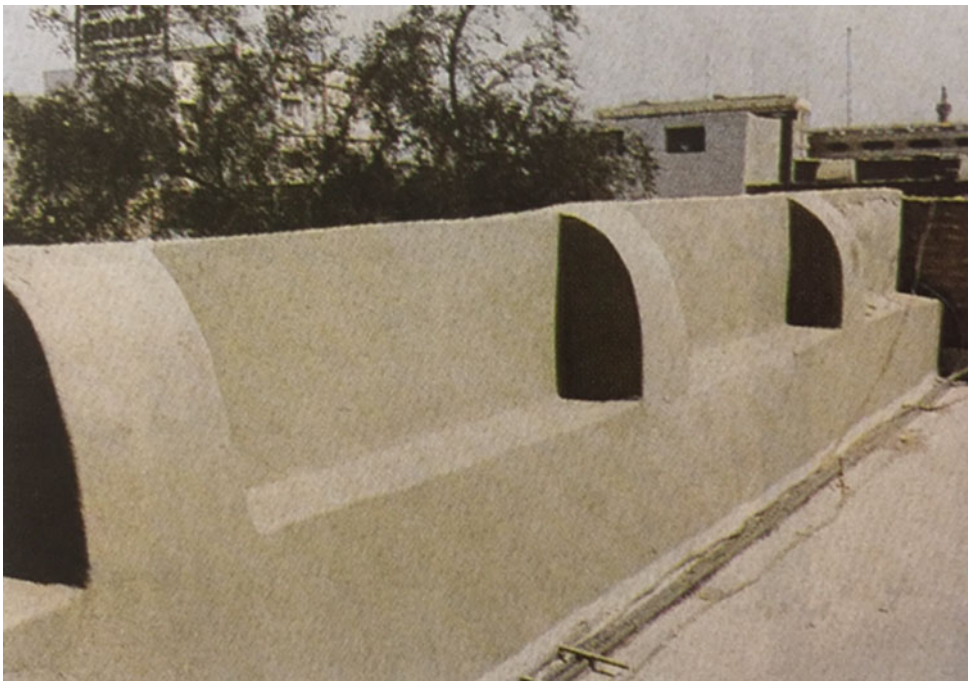

Fig. 21 Wind parapet after restoration (Al-Ghunaim 1999)

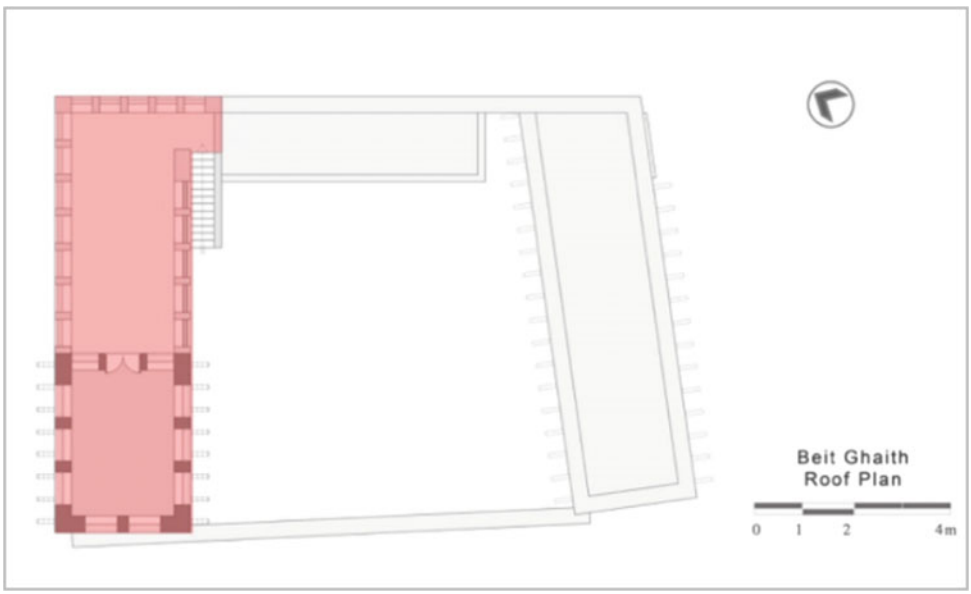

Fig. 22 A plan shows the focus study zone in Beit Ghaith (Murtadhawi 2017)

legislation of traditional building's preservation and conservation practice to include the historical, cultural, and environmental assessment of their passive features as well.

In Kuwait, clearly there is little remaining evidence of original wind tower features; those that remain must be preserved from demolition and neglect. Old photographs, stories and memories, as well as paintings are the secondary sources that have assisted those trying to understand and preserve the past. These secondary sources must be included and covered in historical studies. The significant features of traditional buildings, including wind catchers, require a comprehensive understanding of their design and function. Only then a proper conservation practice can be implemented. Wind catchers have an important heritage identity for each place and need to be recognized as an integral part of Kuwait's architectural character. Therefore, it is suggested that their historical value must be documented, recorded, and published to raise the awareness about their significance. In

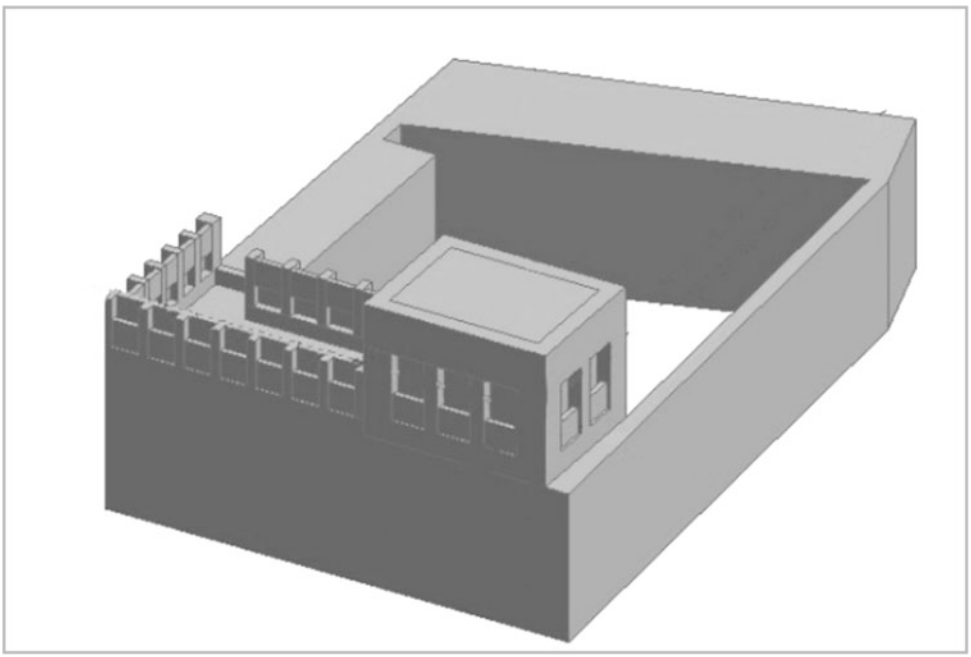

Fig. 23 Model (2) Beit Ghaith, using DesignBuilder software (Murtadhawi 2017)

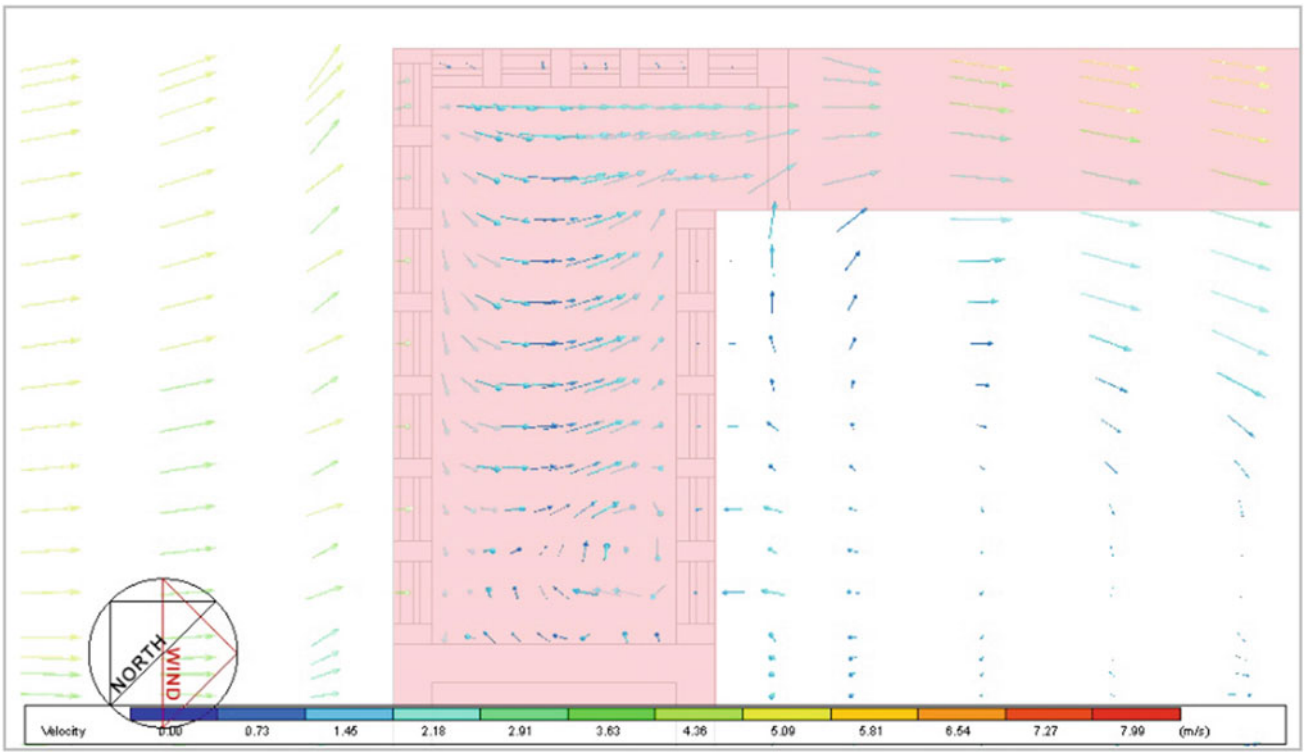

Fig. 24 CFD results showing the airflow pattern by wind parapets (Murtadhawi 2017)

order to best support conservation practices, as well as future developments, the environmental value of wind catchers must continue to be considered through research studies.

The results of this study show that Kuwaiti traditional buildings and their wind catchers are significantly valuable and demand professional conservation practices. Their importance is especially significant when considering the factors that evolved from the political situation in Kuwait and their impact on heritage preservation, along with prevalent economic factors, sociocultural interests and

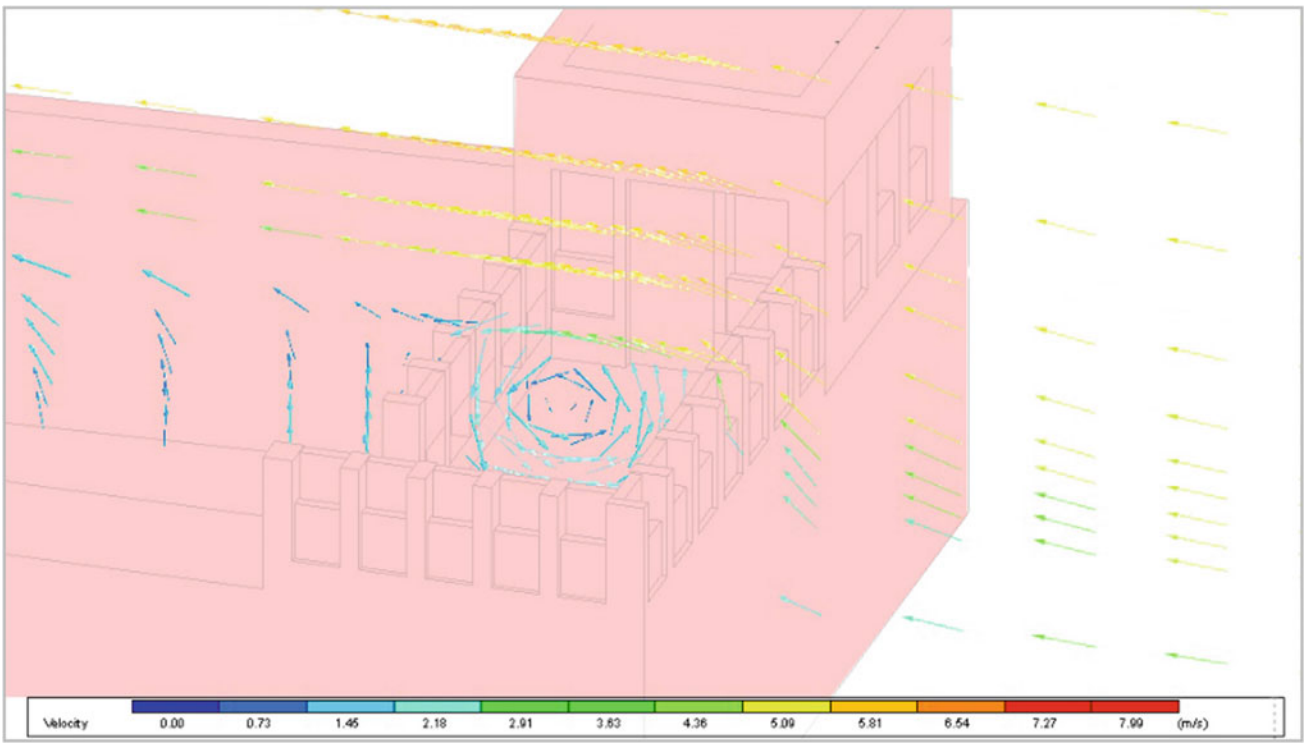

Fig. 25 CFD results showing the air circulation caused by wind parapets (Murtadhawi 2017)

Fig. 26 Wall openings in Al-Ayoub's painting (CRSK 2011)

Fig. 27 Wall opening inside the room by Al-Ayoub (CRSK 2011)

Fig. 28 Wall openings at Koshk Mubarak (Basel 2012)

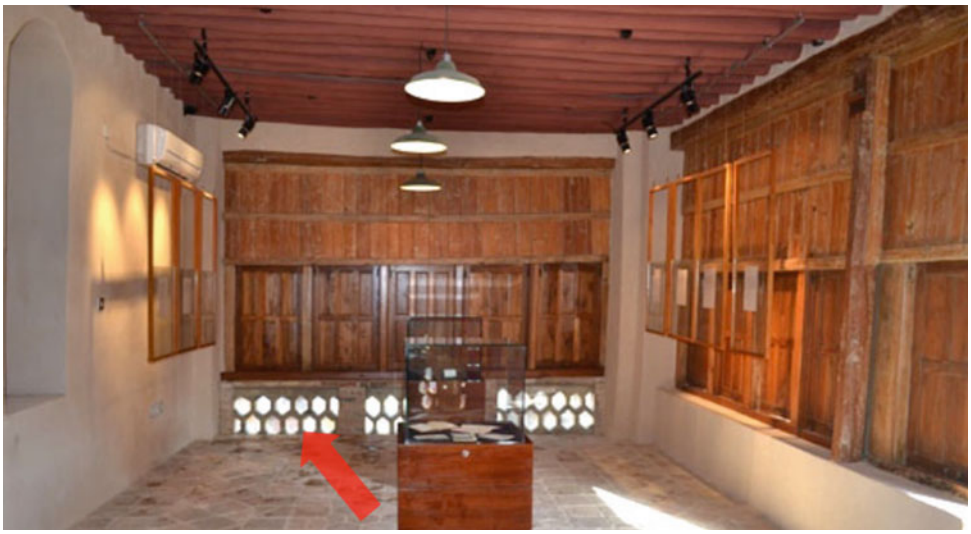

Fig. 29 Wall openings inside the Koshk (Caton and Ardalan 2010)

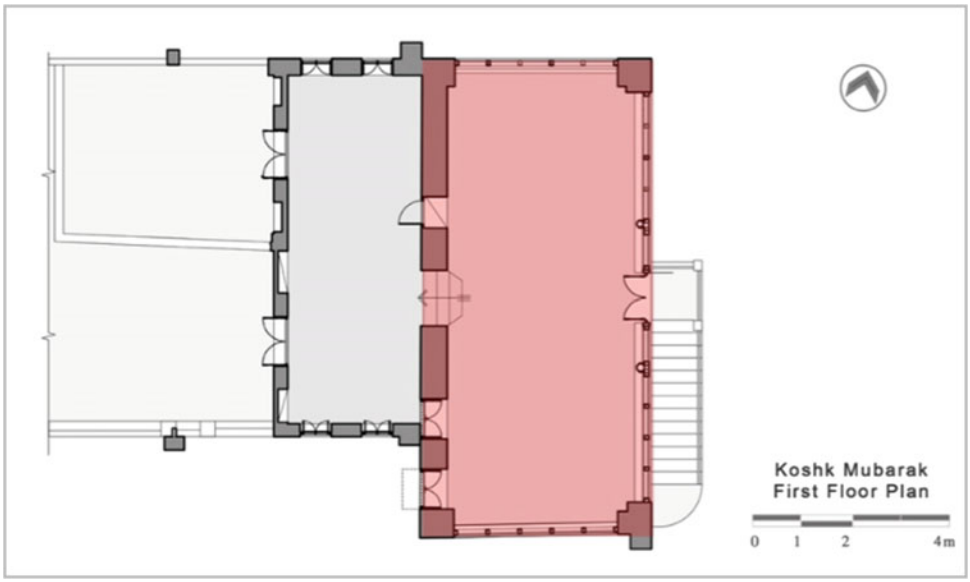

Fig. 30 Study zone in Koshk Mubarak (Murtadhawi 2017)

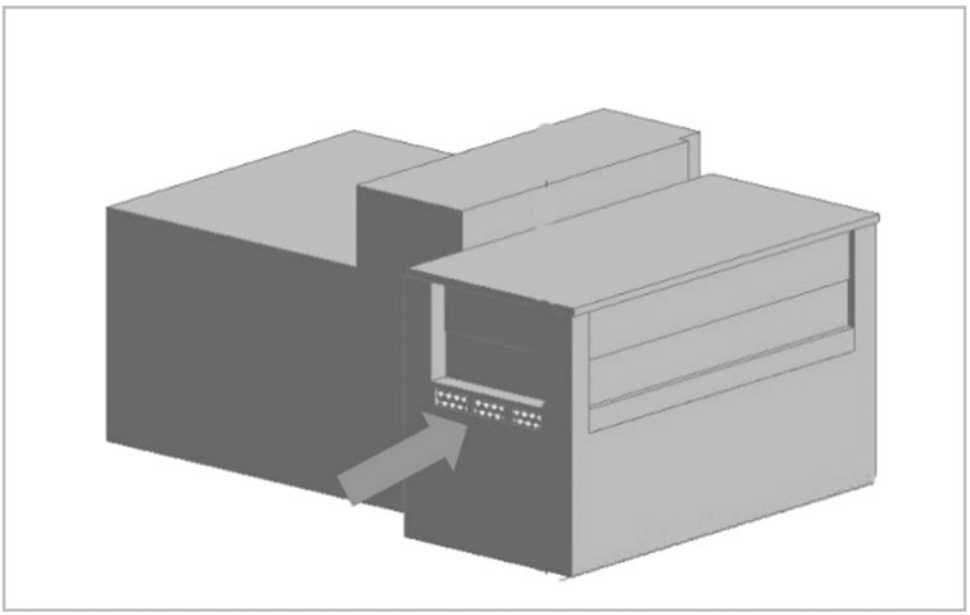

Fig. 31 Model (3) Koshk Mubarak, using DesignBuilder software (Murtadhawi 2017)

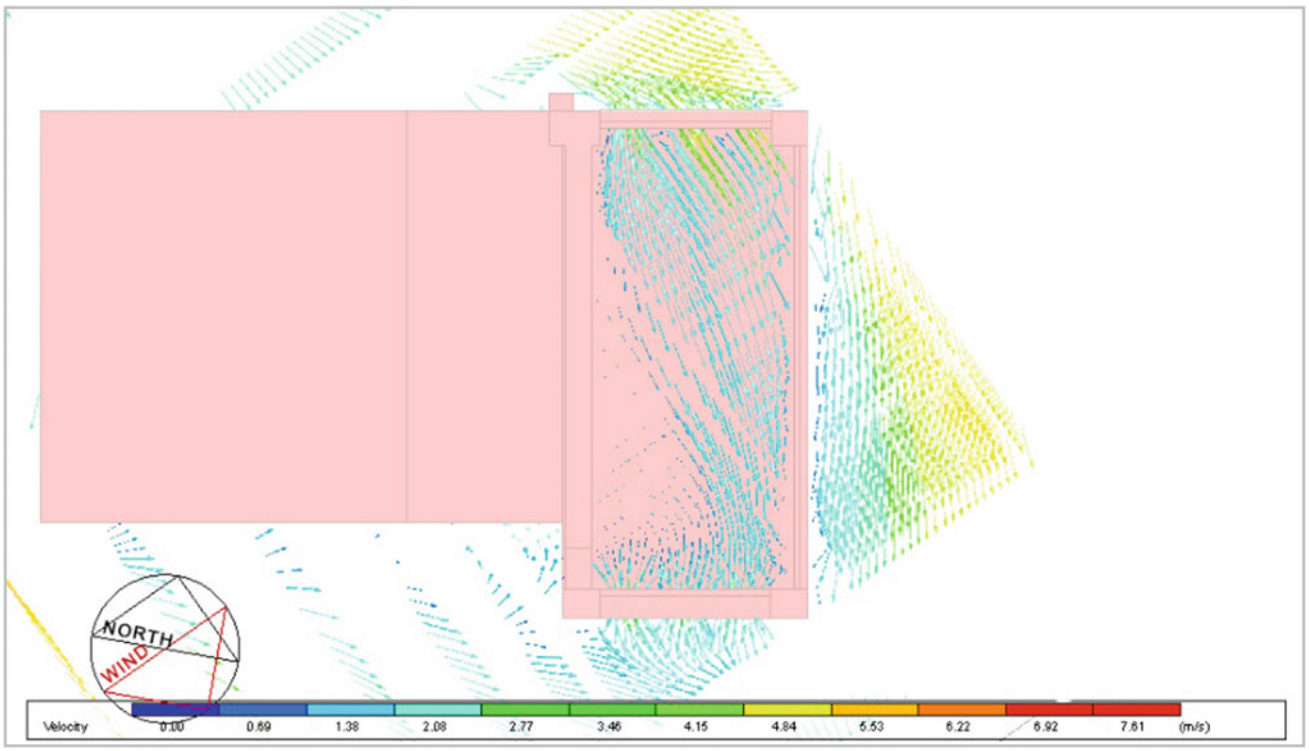

Fig. 32 CFD results showing the air circulation caused by wall openings (Murtadhawi 2017)

influences, technological innovations, international and local preservation and conservation legislation, and current and future environmental concerns. These factors helped assess the value of traditional buildings and their wind catchers in conjunction with their history, period of development, and cultural heritage lifestyle.

This paper has presented sociocultural and environmental influences that contribute to the significance of wind catchers in Kuwait's history. Yet the conceptual models suggest more accurate results that can be obtained using experimental methods via wind tunnel tests. Also, site investigation research is essential to evaluate some tangible results related to the air movement, velocity, pressure, and temperature. In addition, further investigation into primary sources will be critical to achieve a more complete understanding of the cultural significance of passive features in traditional buildings. Finally, additional research should investigate the environmental impact of different wind catchers and other passive features in the traditional buildings, including the examination of their efficiency based on daily and seasonal temperature changes, adaptation of suitable comfort assessment standards, and potential modifications and use in future buildings.

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Penna Brick Factory at Scicli: A Proposal for a Sustainable Reuse in Sicily

Emilia Garda, Maria Luisa Longo, and Marika Mangosio

Abstract

Nowadays, the recovery of industrial heritage can be considered as one of the most effective strategies of cultural regeneration and revitalization of the urban environment and its surroundings. This heritage of largely abandoned production sites represents the memory of a shared social and economic past. They must be returned to society as a collective cultural heritage, becoming an active part in the construction of sustainable development processes for the local communities. The reflection on the future of Penna brick factory—an imposing complex built in Sicily at the beginning of the twentieth century and currently in a state of total abandonment—is placed precisely in this perspective. The recovery proposal, which is described in the paper, is based primarily on a careful reading of the construction history of the building and of the production story, as elements to be enhanced in design choices. The local debate on the building's future is lively and it has suggested the reuse as an eco-museum and a civic cultural center. The project proposal, which stops at a preliminary stage, is based on a bottom-up approach and aims, on the one hand, to revitalize the industrial site and on the other hand to re-launch tourism in this area through the activities of the cultural center.

Keywords

Industrial heritage • Reuse • Social identity • Penna brick factory • Scicli

1 Geographical Contextualization

Proceeding along the provincial road connecting Ragusa to Syracuse, the traveler unexpectedly attends a breathtaking spectacle: the appearance of a huge building, which, thanks to the altitude of the road, seems to come slowly out of the sea, until it settles in all its majesty on the blue background of the Mediterranean Sea between the green–yellow of the reeds.

The complex of Penna brick factory rises in Contrada Pisciotto in the Municipality of Scicli and is known as "Pisciotto." The furnace stands on a promontory just above the Mediterranean Sea, near a long sandy bay (Fig. 1).

The location of the industrial site is by no means casual and is favorable both for the supply of raw materials and for the distribution of the products. A clay quarry is located in a short distance away from the plant, and a natural source ensures the availability of the required amount of water.

The site is also well connected to the provincial road and to the railway network; moreover, the seabed near the promontory is deep enough to allow ships to land. The cargo of goods can easily be transported to other ports on the island and other landings in the Mediterranean area.

2 An Entrepreneurial Challenge

For its impressive location, its imposing stone structure, its articulated layout, and its relevant dimensions, the building can be considered as one of the most significant material evidences of Sicily's industrial heritage.

It is one of the protagonists of the process of progressive industrialization which has affected the region since the end of the nineteenth century. For the time, the plant represents an entrepreneurial challenge, as it encourages the industrial development of an area mainly linked to the extraction of asphalt and promotes the production of bricks in the Ragusa region, geographically closer to the ports of the eastern Mediterranean basin.

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Fig. 1 Geolocation of the brickworks site on a late nineteenth-century map of Sicily

It, therefore, represents a collective cultural asset for local communities, which must be valued and recovered in order to increase the sense of identity and belonging of the communities to the place.[1]

3 Historical Excursus

The *Pisciotto* complex's customers were the Barons Penna, already owners of a small tiling furnace near the future settlement. This small furnace seems to have good economic prospects, so that Penna family can be used to boost production activity, from a craft plant to an industrial plant.

In 1909, the Penna family commissions the work to engineer Ignazio Emmolo, a professional, who has already designed many buildings of a certain consistency in the Sciclitan area (Savà 1999a). The design and the construction of the *Pisciotto* plant commit the engineer Emmolo for three years, during which the professional tries to make the quality of bricks produced competitive, by establishing the plant on avant-garde criteria.

To this end, he visits Spadafora's kilns near Messina, then he goes to Germany to study the operation of the Hoffmann furnace and finally goes to Monza, both to buy additional machinery and to consult the kiln man Illide Pernigotto in order to solve some operation problems of the furnace.[2]

[1]About the concept of industrial heritage as a historical material evidence of the production activity and about the recognition of the vestiges of industrial archeology as cultural heritage, see Battisti (2001), Tognarini and Nesti (2003), Papuli (2004), and Ciuffetti and Parisi (2012). About the history of Sicily's industrial development, see Cancila (1995). For a critical reflection on the reuse of the industrial heritage in Sicily, see Sapienza (2014).

[2]About the diffusion of the Hoffmann furnace in Italy, see Siena (2012).

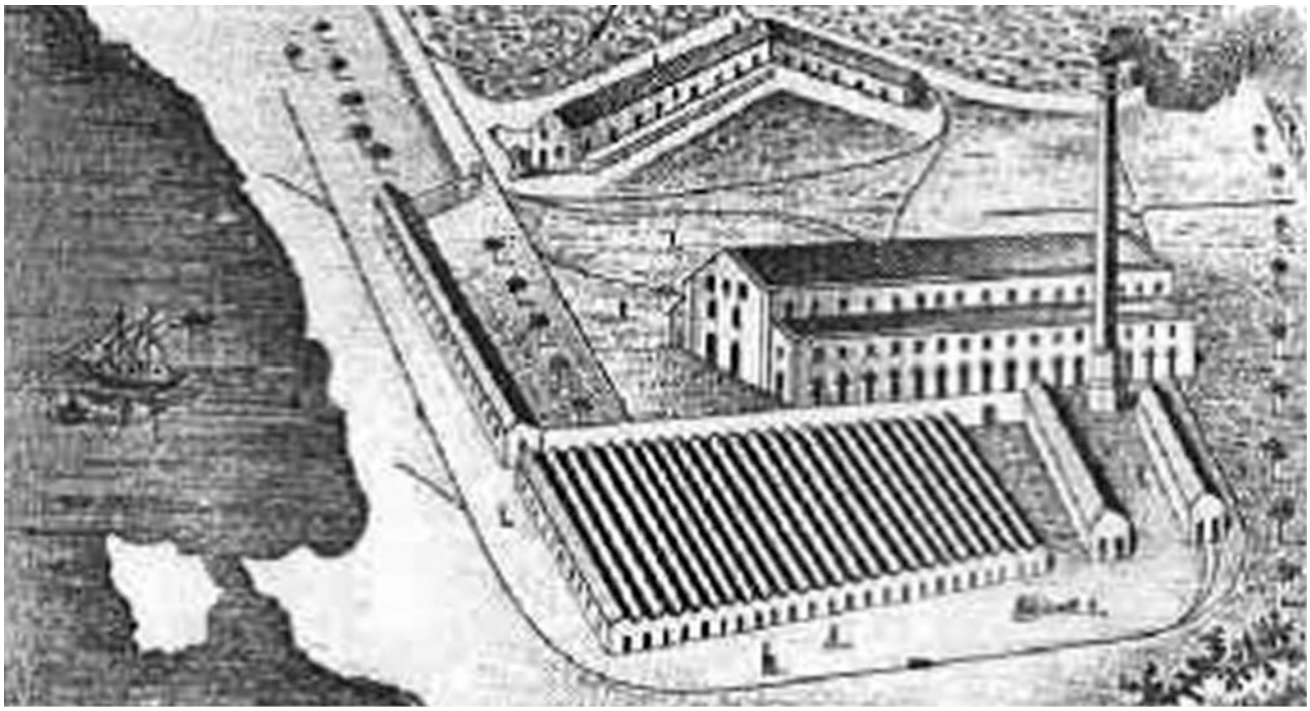

Fig. 2 Scicli, Penna brick factory in a 1921 lithography (Firrone 2013)

The complex is completed and put into operation in 1912. The first orders for brick supply arrive from Libya: following war events, much of Tripoli was rebuilt with the bricks of the *Pisciotto*. In 1915, production stops due to the start of the First World War and due to lack of labor, engaged in the First World War. Underwater warfare in the Sicily channel does not allow the loading and transit of ships.

The furnace reopens in 1919 and the direction of the factory passes from Ignazio Emmolo to some Caltagirone's relatives of Penna barons. The engineer returns to the factory in 1923. On the night of January 30, 1924, the plant, closed for the winter period, is completely destroyed by an arson (Savà 1999b). Mandates and motivations remain unknown till today.

The sad epilogue of this industrial site, which did not achieve ten years of productivity, marks the beginning of a long period of abandonment and oblivion.

4 Physiognomy of the Industrial Site

The industrial site in its original layout extends for approximately 18,000 m^2, including warehouses and department stores. The complex consists of two parts separated by a service area of 6000 m^2 and consists of a factory and an entrance block which houses storehouses, offices, and accommodations (Firrone 2013). South of the plant, toward a second service area of about 10,000 m^2, stands the chimney beside other warehouses (Fig. 2).

The establishment itself has a different articulation than a traditional industrial plant, as it is characterized by a basilica shape. There are, in fact, three aisles: a nave, which is three floors high, and two side aisles, which are constructed on two floors. The nave has a dimension of 82.6 m in length and 13.3 m in width. In the east part, there were the furnace and a storage space for the raw material. The west side of the nave was destined for the machinery and contemplated the presence of two hammer sprayers, a kneader, two rolling mills, a revolver press for the production of Marseille clay tiles and a press for the production of roof ridge tiles. The plant was made up of an 80 HP power engine, a lift, a hoist, and a conveyor belt.

The Hoffmann furnace consisted of 16 rooms, to compose approximately an ellipse, mostly 5 m long, 3.5 m wide and 2.80 m high. Each room was capable of containing 10,000 pieces and was powered from above. The forced draft was exerted by the 41-m-high brick chimney, placed on a tall stone base.

The building is entirely made of dry masonry, consists of hard to face limestone blocks of irregular surface, according to the local building tradition.

The interior walls of the inner nave rise to 16 m high and have full arch openings on the ground floor and at the upper floors, skene arch mullioned windows to ensure optimum natural lighting.

The same rhythm is also maintained along the outer building envelope of the side aisles. The two fronts highlight the typology of the basilica. Particular attention is paid to the construction of the quoins, doorjambs, and archivolts of the openings, for which there are ashlar stones and keystones in relief (Fig. 3).

Fig. 3 Scicli, Penna brick factory. A detail of the dry masonry. Ph. Pasquale Bellia (www.ragusanews.com)

5 Production Process

During its production phase, the factory was put into operation every year in early May and was closed usually in October, when the first rains flooded the quarry, preventing clay extraction. The production process is divided into six distinct phases extraction of clay, preparation, shaping, drying, firing, packaging, and delivery.

Clay extraction from the quarry is a complex operation as the deposit does not appear on the surface, but it is under a sandstone layer. Once excavated, the raw material is transported to the plant through a Decauville, whose wagons are pushed by men or drawn by beasts of burden.

Once arrived at the plant, the clay is placed in tanks containing water, beaten and macerated. After the maceration, the material is worked by adding sea sand.

The mixing is passed inside a wire drawing machine: This machine has a twist mechanism that pushes the clay toward an extrusion die, which provides the desired shape. They are thus made into bricks, hollow bricks, cobblestones, Marseille tiles.

The shaping phase is followed by drying phase, necessary to remove excess water in the semi-finished product before firing in the furnace. The bricks are exposed to the sun for a period of 12–24 h, to allow water to evaporate from the surface; subsequently, they are arranged overlaid for about 10 days to allow total drying. This process takes place in special driers, planted in the south service area for full and hollow bricks; the most delicate materials, such as curved tiles and Marseille tiles, undergo the drying process in a covered, ventilated room. This place is located in the upper floors of the establishment.

After the drying, the material is introduced into the Hoffmann furnace, which is an avant-garde plant for the time, capable of firing brickwork with a continuous cycle and a mobile fire wagon: the material remains stationary while the fire is moved from one room at the next, along a horizontal path.

The oblique split of the oven identifies two main areas: an area accessible from the outside, which is used to import and export the material; a larger area where firing is completed through an airflow. The molding of the bricks provides, in fact, a preheating of the material piled in the firing chambers.

Then, at first, air is poured in, slowly cooling the material, then heated, and then, at a later time, expelled from the cells through pipes connecting the said cells to the damper. Air draft is carried out by the chimney. After cooling, the materials are dried and subjected to firing at a temperature between 800 and 1200 °C. The production cycle of the firing is varied by shifting the fire of one or two rooms every 24 h and at the same time also the rooms where the air is entered.

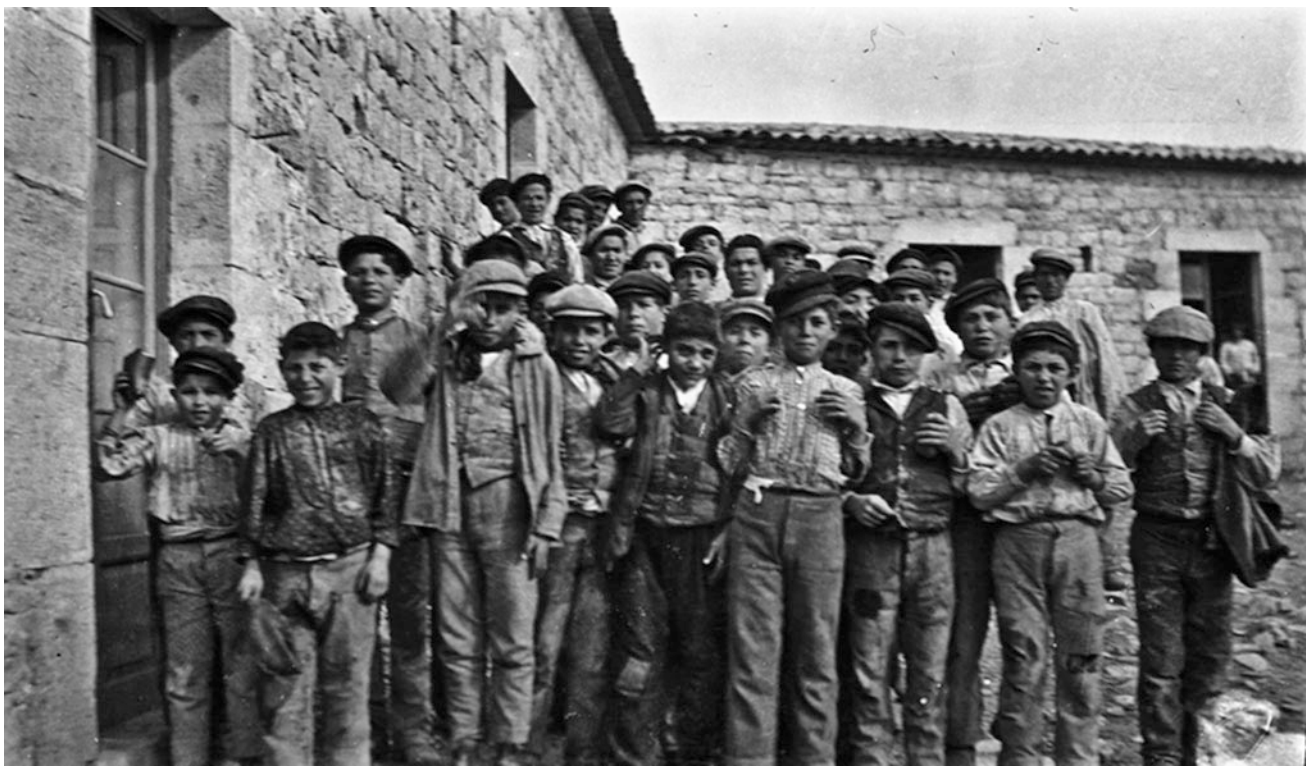

Fig. 4 Scicli, Penna brick factory. Young workers, early twentieth century (*Giornale di Scicli*, 17 Dicembre 1995)

The firing process initially does not prove effective in producing quality products and is developed thanks to a fortuitous event. On August 15, 1912, the workers take half-day leave to celebrate the *Ferragosto*, leaving the furnaces lit up in a very low fire. The bricks, casually left inside the hobs, reveal themselves perfect. Engineer Emmolo concludes that that kind of clay needed to fire slowly and in order to achieve this, he replaces fossil carbon with *sansa*.[3] In its productive season, the plant produces about 10,000 pieces per day as bricks, hollow bricks, curved tiles, and Marseilles tiles.

After firing, the bricks are transported through Decauville[4] to the factory storage sheds and then exported for sale by rail, by farm trucks, or by sea. In the next phase, the material is transported to the shore, always by Decauville, loaded on boats at a wooden floating dock and subsequently transported on cargo ships, moored near the cliff.

Despite the innovative component of a part of the plant, this type of furnace has some disadvantages: on the one hand, an excessive use of labor, forced to work under difficult conditions, due to high temperatures and dust; on the other hand, a high cost of energy to be used.

A hundred men aged between 16 and 18 found employment in the kiln (Fig. 4). The hammer sprayers, the kneaders, the wire drawing machine personnel, and the kiln loading and unloading workers are adults and of an unspecified number. The skilled workers are a mechanic, found in Milan, a technician and his assistant, a carpenter, the kiln man and his help, both of which are from Monza.

6 Current State of Conservation

After the fire in 1924, the activity was not restarted and the furnace was forgotten for more than fifty years wind farm (Fig. 5). In the 1980s, the complex was finally recognized as a monumental heritage and as such a place under protection by the superintendence. During this period, numerous proposals for recovery have been advanced, followed by a long, deafening silence on the *Pisciotto*.

No maintenance, conservation, or consolidation works have been carried out on the building, which is currently in a state of advanced decay.

Due to the arson, all the wooden elements of the building have been lost, such as interior doors, exterior doors, and the entire roof. The lack of an adequate protection structure has inevitably triggered serious degradation on the masonry. The wall structure of the establishment and the chimney still survive. The east façade of the building appears to be heavily deteriorated; the full arches at the bottom and the first row of mullioned windows over the arches still resist. The southern façade is in the worst condition, as it has collapsed in the central part in 1993. The chimney was first struck by a lightning strike and was partially collapsed in 1989 due to the weather.

Nothing remains of the wooden slabs, except for the tiny traces of material, in the support of the heads of the beams. The north block, with the warehouse and workers' lodges, and the Hoffmann furnace appear less deteriorated than other parts, but are in part inaccessible because of the thick vegetation grown over the years.

Nowadays, the Penna brick factory stands like an ancient lay cathedral in ruins (Fig. 6).

7 Reuse Hypothesis

Over the years, Penna furnace has been the subject of countless debates, comparisons, interventions by the Ragusa's sovereignty, redevelopment proposals, conservation projects, visits by the Ministers of Cultural and Environmental Heritage, interventions by UNESCO, complaints and appeals in articles of newspapers, but unfortunately they have never led to anything concrete.

Among the proposals for the recovery of the industrial building are the reuse as a museum, service facilities at the marina, a theater, a hotel, or a wind farm (Bellia 1989, 1995).

In the early twenty-first century, the furnace gains national visibility, because it is chosen as a singular setting for some episodes of an Italian famous television fiction. The public administration has increased its attention on it (Firrone 2017); the owners have come back and, finally, a primary importance factor, a deep interest in preserving the complex as a shared cultural heritage, has been created in the local people.

Two main trends in recovery proposals emerge: the recovery of the furnace as evidence of the first stage of industrialization of the region and, on the other hand, the transformation of the establishment into a luxury hotel.

The first proposal is supported by the inhabitants of Scicli, who are very sentimentally attached to the site and ask the competent authorities to secure this heritage, respecting its original use. They consider the furnace with its open spaces a testimony of the integrated society of the period, as all around this emerging architectural element there was an economic, social and technical microcosm, with which it came into contact through a dense relationship network.

[3]The *sansa* is a by-product of the process of extraction of olive oil, composed of skins, pulp residues, and olive nugget fragments, which among its uses boasts that of heating fuel.

[4]Decauville railroads, born in 1875, are narrow-gauge railways, whose track consists of prefabricated elements that can be mounted and dismantled quickly. They are used almost exclusively for the carriage of goods such as minerals, wood, peat, clay, and sand.

Fig. 5 Scicli, Penna brick factory. View of the furnace before the Second World War (www.corriere.it)

The second proposal is backed by the twenty-one owners of the property, who do not have the funds for safe-keeping and who see in the infill of *Pisciotto* as a hotel, a tool to enhance the surroundings of Scicli (Drago 2003; Savà 2003). In accusations made by citizens, unfavorable to the hotel's realization, the owners reply that, as at the beginning of the twentieth century, Baron Penna built the furnace with the idea of creating an entrepreneurial activity that represented a safe workplace for many workers, today their descendants intend to promote a more modern production enterprise, which will create new employment opportunities.

8 Recovery Proposal

The recovery proposal which this paper intends to submit for the *Pisciotto* industrial site has, as fundamental prerequisites, the choice to recover the building, respecting its original structural and technological features[5] and the intention to consider the real social and cultural needs of citizenship, considering spaces and functions which can be used by the entire local community.[6] Simply securing the factory is not in fact considered a sustainable solution in the broad sense.

The proposal, which can be considered a preliminary project, provides for the recovery of the Penna complex as an eco-museum and a cultural center, a purpose which is rooted in the cultural and social fabric of the place. The solution aims to enhance the original use and its relations with the area and to involve the local population in reappraising these spaces, which are rethought on the basis of a well-defined requirement framework.[7]

The new structure should also accommodate other homogeneous communal services, becoming a wider reference cultural hub for a catchment area larger than the Municipality of Scicli.

The eco-museum reflects a new vision of the management and enhancement of tangible and intangible cultural heritage. It is a development strategy based on the sense of belonging to own roots and to the local cultural landscape, in order to enhance realistic and site-specific forms of social and occupational re-launching. The proposal also aims to

[5]About the disciplinary theme of the reuse of industrial heritage and about the most appropriate recovery choices, see Parisi (2009) and Vitale (2013).

[6]In support to this intention, see Spaziante (2011).

[7]The new use as an eco-museum is considered particularly significant in the present proposal, because it is based on participatory planning as a conciliation tool and because it is in line with the most current territorial marketing strategies, which allow interpreting the true needs of a region, also through the enhancement of the *genius loci,* with the objective of a harmonious local development. See Caroli (2013) and Reina (2014).

Fig. 6 Scicli, Penna brick factory. Present view of the furnace. Ph. Massimo Grassi (www.etnaportal.it)

Fig. 7 Kunshan (China), Zhujiadian Brick Kiln Museum, 2016. General view of the complex. Ph. Guangyuan Zhang (Land-Based Rationalism D-R-C 2018)

promote the diffusion of eco-museums in Sicily until today only three have been opened.

The project had two important references, the Eco-museum of Freidano in Settimo near Turin, Italy, and the Zhujiadian Brick Kiln Museum in Kunshan, China.

The first effectively combines the concept of eco-museum with the reconversion of a decommissioned industrial building and represents a successful example of regeneration of the local fabric. It consists of an interactive ethnographic museum, placed in an ancient mill, near the Freidano River and of an Energy Park (Silvetti 2007).

The Zhujiadian Brick Kiln Museum is significant both for the concept and for the design solutions (Figs. 7 and 8). The village of Zhujiadian was the site of the brick production for the Forbidden City and has more than ten kilns. The museum was created in 2016, thanks to the local administration, as "micro-intervention," to revitalize the entire village, currently in a state of abandon and to raise awareness of this important production tradition. The presence of the museum determined the development of commercial activities and the repopulation of the village. The brick envelope of the furnace encloses a new modular steel structure, which guarantees great flexibility in the use of spaces and which supports the large pitched roof. The terrace on Changbai Lake is one of the defining elements of the project (Land-Based Rationalism D-R-C 2018).

9 Project Description

With reference to the general site master plan (Fig. 9), the entrance to the complex is from the north, to facilitate access from the provincial road, while the exit takes place along the east side of the complex. The parking area G is near the entrance: the location at this point allows us to hide the view of the parking from the provincial road. Building A houses the keeper's residence, whose location during the museum's opening hours is located in building B: in this way, he can control the entrance of the vehicles and have a complete view of the entire lot. Block F is a further control station from which to verify the departure of the vehicle from the site. The technical premises for centralized control of the installations are located in buildings C, while block E contains storage spaces. The preexisting building next to the main entrance, marked by the letter D, houses the heart of the eco-museum, where a guided tour illustrates brick

Fig. 8 Kunshan (China), Zhujiadian Brick Kiln Museum, 2016. View of interior spaces. Ph. Guangyuan Zhang (Land-Based Rationalism D-R-C 2018)

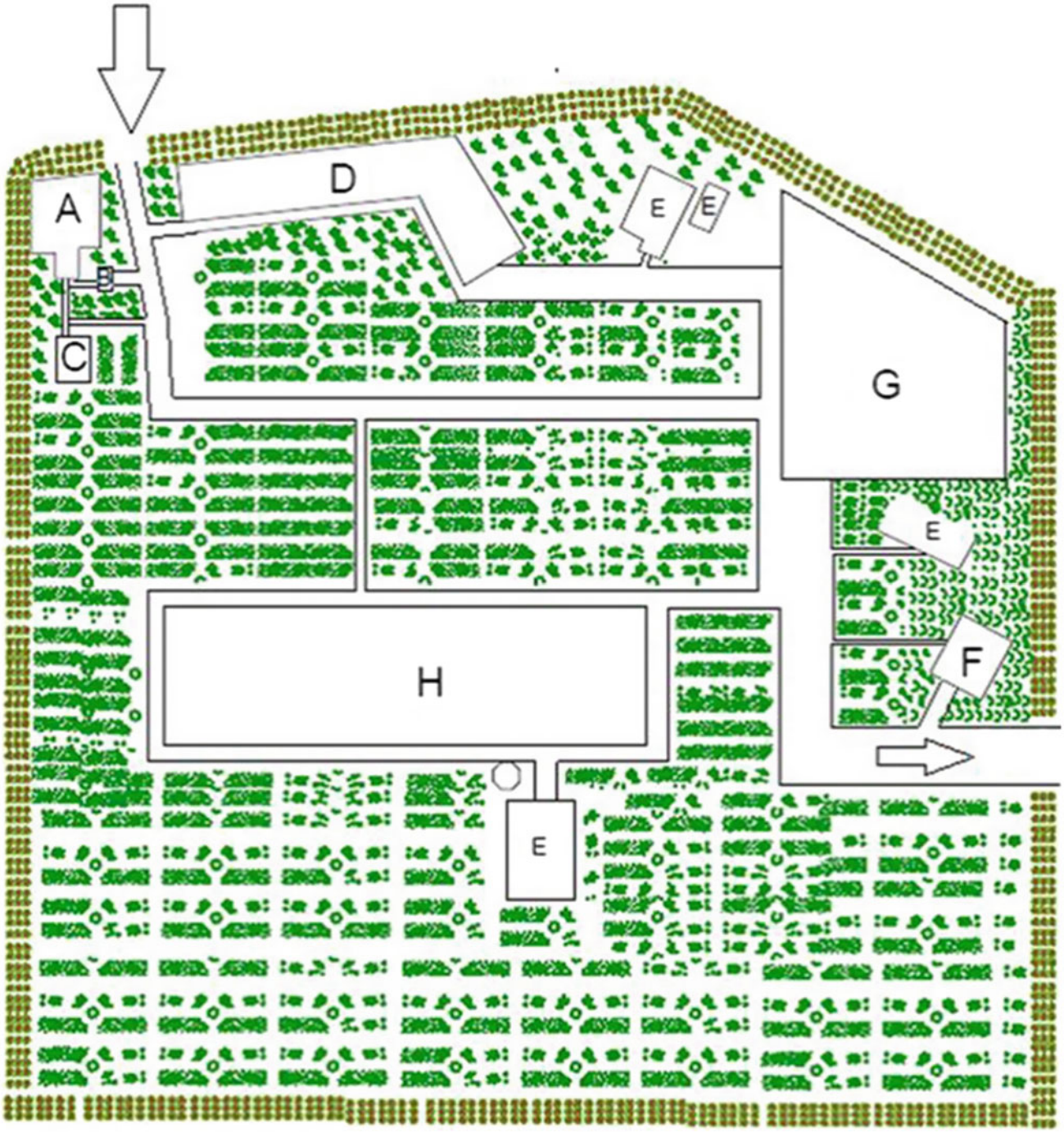

Fig. 9 Master plan of the recovery plan of the industrial site. A: keeper's residence; B: porter's lodge; C: control unit; D: eco-museum; E: storage space; F: control station; G: parking area; H: cultural center (drawing by M. L. Longo)

production technology, machinery, life and work histories linked to the industrial site, in order to maintain the historic memory of the furnace and to introduce new generations to the history of the *Pisciotto*.

The creation of a "live" archive of tangible and intangible local industrial heritage is considered an integral part of the eco-museum program. In fact, there are few in-depth studies on the historic industrial development in the Ragusa region, so the purpose of this participated archive is twofold: to increase awareness among the locals about their own cultural identity and to provide useful material for future research. In addition, the eco-museum can accommodate laboratories on

clay processing and bricks production and promote training courses for unemployed people seeking professional retraining.

Building H, which is the actual establishment, is the main core of the recovery proposal. On the ground floor, there is an entrance hall, which accommodates the ticket office, allowing access to the exhibition halls of the center and the library, respectively (Fig. 10). The latter occupies the spaces of the old Hoffmann kiln: In the central area, protected from natural light sources, the books are placed in consultation, while the reading room develops all around, with distinct areas for reading and for study and consultation.

The first floor hosts other exhibition spaces, arranged according to a guided tour, while the last floor is designed to host conferences and training courses, thanks to the presence of a large auditorium and small classrooms (Figs. 11, 12, and 13). The small congress center is complemented by a restaurant, featuring a covered area and a large terrace, allowing visitors to dine while admiring the panorama. The kitchen is located in the central part of the restaurant, which can also organize buffet lunches for the conference participants. Lastly, it is proposed to reuse the chimney for the forced draft natural ventilation of the complex, in order to ensure optimum thermo-hygrometric conditions in indoor environments, particularly during the summer season.

The project presupposes the structural consolidation of the building with mortar injections to reinforce the walls and the insertion of metal tie rods acting as perimeter curbs. In this way, the connection of the resistant walls is effective, as this can guarantee the box-like behavior of the building and the optimal exploitation of the residual structural performances. The stone walls of the furnace are kept as a simple shell and they will not have a load-bearing function: The structure of the internal volumes will be in steel and will be conceived in total independence from the stone envelope.

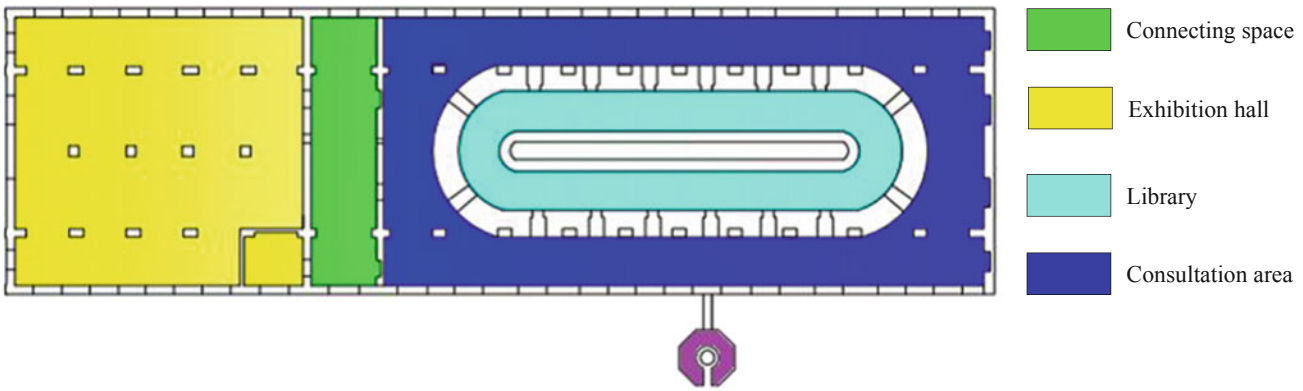

Fig. 10 Recovery plan, ground floor plan (drawing by M. L. Longo)

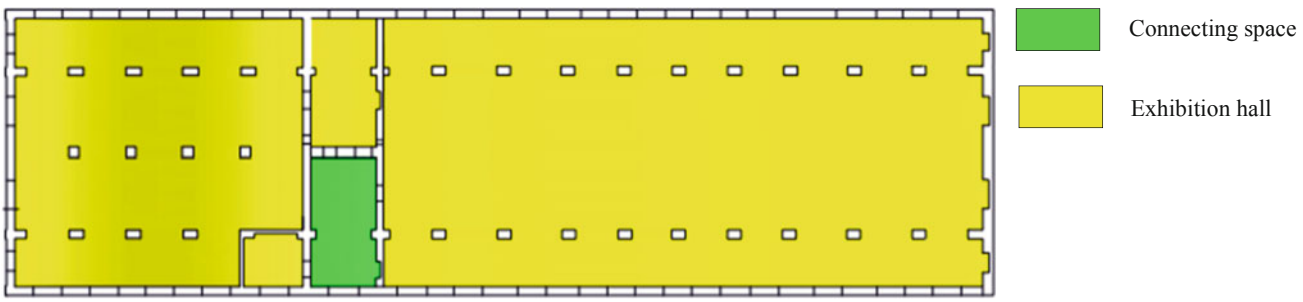

Fig. 11 Recovery plan, first floor plan (drawing by M. L. Longo)

Fig. 12 Recovery plan, second floor plan (drawing by M. L. Longo)

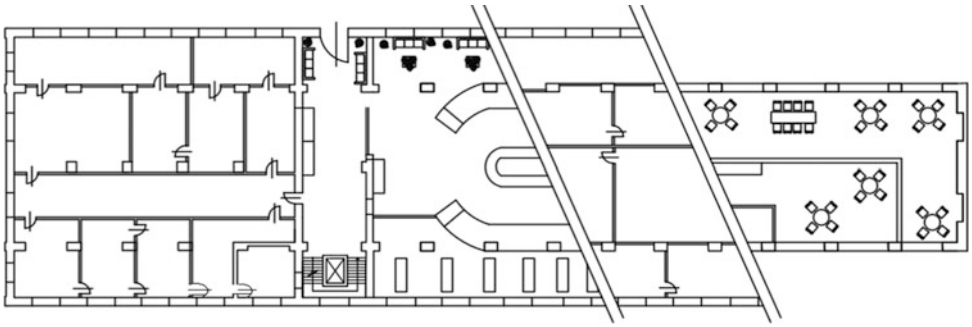

Fig. 13 Recovery plan, layout detail. On the left, exhibition spaces, the ticket office, and the library on the ground floor; in the center, exhibition spaces on the first floor; on the right, the restaurant on the second floor (drawing by M. L. Longo)

10 Conclusions

The sustainable enhancement of a wide heritage, such as the industrial one, is nowadays the main intervention strategy for the regeneration of this heritage. The proposed recovery plan arises from the attempt to reconcile the need to preserve a physical presence, which has a very strong identity value for the inhabitants of the local community, with the need to link it to the development of the region in a dynamic and sustainable way. The sustainability of a recovery proposal cannot only be based on eco-compatible or energy-saving design, or on the economic self-sufficiency of the new use, but must also be broadened to the social dimension of the project. The reuse of the brickworks as an eco-museum can enhance the collective memory of a local community, outlining lines of future development consistent with the needs of the community itself, which becomes an active part in the transformation process of whole area.

The involvement of the citizens in the design process, in the management phase and in the use of spaces, can be considered the premise in order to keep the building alive over time. The recovery of local identity, the respect for local construction techniques, the creation of a shared sense of belonging and the careful listening to cultural needs not yet expressed are the tools through which it is possible for the Penna brick factory to become a sustainable reuse.

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Architectural and Urban Expression in Nubian Village Origins and Transformation with Special Reference to Displacement Villages

Mona Y. Shedid and Gehan I. Hassan

Abstract

The urban environment is the physical frame which satisfies human needs, and they largely reflect the character of society. The nature of this interaction depends to a large extent to the formations of this template including the buildings, spaces and services. It provides social relationships and interactions, as well as for human models with multiple cultural backgrounds. And as the physical framework affects the behavior and personalities of those who occupy it, individuals and groups influence their role in their urban environment and volunteer it and subject it to their desires and requirements. The paper considers Nubian Communities as a distinguished manifestation of the reciprocal relationship between people and places, and the resulting culture, cultural patterns, architecture, and built environments. It follows selected displaced Nubian Communities in their new settings, the "migration" villages, "Isna" district, "Qena" Governorate, Upper Egypt. The paper records and presents the Nubian Communities' interventions in buildings and built forms of those villages. It compares the new buildings and settings with the deserted traditional Nubian dwellings and settlements, before displacement. The research also addresses the reasons behind settlers' additions, and its relation to Nubian culture and indigenous physical expressions, in order to reach the formulation of a living environment that stimulates communication and social interaction among its users and also meet their requirements and various activities so as to feel the enjoyment and comfort and also reduce the encroachment on the surrounding environment.

Keywords

Social • Culture • Nubia • El-Tahjir • Setting • Architecture • Urbanism

1 Introduction

Culture plays an important role in architectural and urban outcomes. It is also an important factor in the formation of urban character as the urban environment affects and is affected by the people and societies it surrounds and is in contact with. It is also considered the main active constituent of the daily living experience and man's interaction with his environment and surroundings.

In order to achieve a healthy urban environment that fulfills the material and psychological needs of its users, the cultural and historical dimensions as well as the heritage of these societies must be studied.

The environments with historical dimensions that are related to defined locations and geographical spaces provide a good field to study the relation between the culture of the environment and its physical outcome in the form of architecture. The case of the Nubian society provides a unique example of the relation between environments, persons, space, and architecture.

Hence came the choice to study the Egyptian Nubian society that has undergone major changes in the persons and society and their natural and urban contexts over the past 50 years which reflected on the social life and the interaction between the users and the surrounding environment. This is documented by the unique architectural characteristics that really expressed the geographic environment and the human culture and was also evident in the interaction of the Nubian villages from the urban aspect with the natural and environmental conditions and in the emergence and continuity of the local architectural pattern with its unique characteristics.

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2 Objective and Hypotheses

The aim of this paper is to trace relation and interaction between the Nubian society, location, and the urban contexts before and after the migration of the Nubians. This is followed by evaluation of the reaction of the users (Nubian) toward the design to document the modifications and additions to improve the fitting of the design to the realities of their behavior and social needs.

This will be done by studying the following:

- Monitor the reality of Nubian resettlement villages in the area of "Esna" in Upper Egypt, Qena Governorate, Egypt.
- Compare between the traditional and resettlement Nubian villages.
- The study traces the reasons behind these additions and modifications, through an analysis of a resettlement village, which includes important aspects such as the Nubian life, social, cultural and economic, and monitoring the distinctive features of residential and urban communities.

3 Methodology

The research methodology is qualitative, based on data collection and theoretical analysis of a comparative study between the architectural features. The main purpose of this comparison was to improve the quality of life of the Nubian people after the displacement.

It consists of three main parts:

Part one: Follows some of the aspects of the Nubian culture and highlights them through the concentrated display of their origin and changes that they underwent.
Part two: Follows some of the characters of architecture of the Nubian villages before emigration.
Part three: Focuses on the experience of Nubian villages to measure the degree of change in the Nubian society to cope with the new environment.

3.1 Study Area

One of the emigration villages was established after the building of the high dam in the 1960s, thus allowing the effects of the interaction between the inhabitants and their new environment to be identified.

The study is mainly focused on El-wasty (one of the villages of Thomas and Afia), as it is the most representative of the cultural characteristics of the emigration villages in Isna. Its local community is peculiar in its diversity and collaboration. The effort given by its inhabitants in improving the quality of life and urban details is very prominent.

3.2 The Questionnaire

The questionnaire form was designed to be based on a logical sequence of questions. The general content of the questionnaire was divided into three parts:

- Part 1: General data of the family and the features of the urban space.
- Part 2: Data on the urban and architectural features, this includes the general data about the Nubian houses and their urban spaces.
- Part 3: Remarks.

The questionnaires were distributed to 25 permanent residents. It was filled by the researcher, depending on photography, as a basic tool of monitoring the facades, as well as writing notes and drawing sketches.

4 Nubian Life/Origins

The African land of ancient Nubia was located in the Nile Valley immediately to the south of ancient Egypt. Over time, people in this region developed a number of cultures which drew on both African and Egyptian traditions. It was the seat of one of the earliest civilizations of ancient Africa, with a history that can be traced from at least 2000 B.C.

4.1 The Geographical Location

Nubia was divided into two main regions: Lower Nubia and Upper Nubia. Lower Nubia (The Egyptian Nubia) is a 320-km-long sector of the Nile Valley between Aswan and Adindan that used to connect Egypt with Sudan. The Nubian valley is mostly very narrow, lined with mountain slopes, steep above the right bank.

At the time of resettlement in the early 1960s, there were an estimated 50,000 Nubians living in 39 villages, divided into three basic residential areas: the area of the Wadi El Kunuz and called (Matoki), the Wadi El Arab and called Arabs Aqeelat, and an area called Fadigga (Edward 2004).

4.2 The Characteristics of Nubian Population Before the Migration

The Egyptian Nubian population consists of three distinct ethnic groups: The northernmost one, formerly living in the area between Aswan and As-Sebua, are the Kenuz, descendants of the Nobadae from Graeco-Roman times. Their close relatives in the southernmost Egyptian Nubia between Korosko and Adendan are the Fadidja, who often call themselves "Nubi," and are also descendants of the Nobadae. Between these two groups, various Nubian Arab tribes settled down in the fourteenth century AD in a 30-km-long stretch of the Nile Valley lined with hills on the right bank, between Wadi el Arab and as-Sinqari, cutting the Kenuz off the Fadidja. Another ethnic group—the Ababda, originally nomads of the Eastern Desert—have been gradually settling down, recently in some Kenuz villages and in Arab villages (Elhabashi 2014) (Table 1).

4.3 Settlements and Housing Patterns

The Nubian settlements (villages) had several unique characteristics, in terms of the settlements' pattern and housing. The most important characteristics can be listed as follows:

There were two types of settlement patterns in Old Nubia:

- The grid pattern that is usually found in the southern part of Nubia on flat lands where dwellings were organized in rows parallel to the Nile.
- The free pattern that was usually found in northern Nubia where the settlements stood mostly on hills leaving the flat lands for agriculture; see Fig. 1.

The biggest or most important local settlement (naga) in the village became the seat of the mayor (omda), school mosque, and community house for meetings and gatherings of the inhabitants; see Fig. 2. The small settlements were connected by bad sand roads only in the southern part of Nubia, while in the north only by paths trod by pedestrians. Wooden sailboats (felukas) were solely used for transporting people and goods. Since there were no shops in the settlements, local traders brought basic food and various goods from Aswan to be sold directly from their boats; see Fig. 3 (Herman 2009).

4.3.1 Traditional Nubian Housing

Most of the houses were built in the form of a rectangle with an area roughly from 200 to 1000 m^2, and it depends on the site and topography.

The traditional Nubian housing will be studied through the following points:

- **Nubian Housing Design**:

Many factors have affected the design of the old Nubian houses, such as the climatic, geographical, and the social needs. The following figures show the Nubian houses, and their most important components (Elhabashi 2014) (Table 2).

- **The Main Entrance**:

The main entrance has formations that distinguish it from the rest of the house, which in most cases leads to an open courtyard mediates the house, if the house area is relatively small becomes the majority of the yard shaded, and there is a small side entrance used especially for women and opens into the inner courtyard directly; see Fig. 4.

- **The Madiafa**:

Madiafa is the guest room, located next to the main entrance, and opens to the inner courtyard right inside the house; see Fig. 5 (Kamel and Abdel-Hadi 2012).

- **The Courtyard**:

It is an open space in the middle of the house. It is found in all Nubian houses and in different areas. It opens on all rooms of the house used for living purposes, in addition to its environmental and climatic role; see Fig. 6.

- **The Windows**:

Windows are not found in the Nubian houses. Instead, there are small openings called "Al Takat" at the top of the walls which can be closed in the winter. This is due to functional and climatic reasons, so that the air moves inside the courtyard, and then, the warm air comes out through El Takat; see Fig. 7.

- **The Semi-Circular Vaults**:

This is a type of curved surface forming a vaulted structure. The mud brick structure was revived by Egyptian architect Hassan Fathy after re-discovering the technique in the Nubian village of Abu al-Riche. One of the key advantages of the Nubian vault is that it can be built without any support or shuttering; see Fig. 8.

- **The Decorations**:

The decoration of the Nubian houses is related to the history of the Nubian dwelling. They use the decoration of

Table 1 Different characteristics of the Nubian population

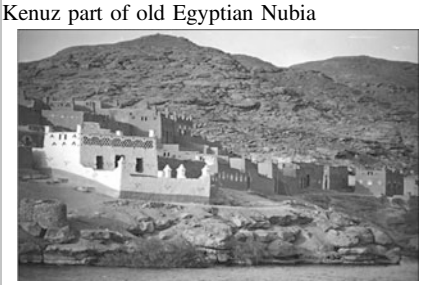
Characteristics	Description	Figures
Settlement pattern	The character of the countryside and the rise of the Nile level conditioned the settlement pattern of Egyptian Nubia. It consisted of typical small settlements (nagas) with dozens of houses dispersed through the country. They were originally seats of certain descent groups, as evidenced by the names of some nagas identical with the names of descent groups; see figure. Some 10–20 nagas were grouped together into administrative units, villages (qaryas or nahias) with a hundred or more houses	Small settlements (nagas) along the Nile in the Kenuz part of old Egyptian Nubia 
Economic activities	**Agriculture**: It is considered one of the most important economic resources, and it is considered a cooperative collective activity within the family; see figure. **Handicrafts and traditional products**: Most Nubians worked in handicrafts, whether for use or cosmetic, and they excelled in the wool industries, balms, beads, jerger, and jalabiya, and the manufacture of wicker dishes decorated with vegetal and geometric shapes	Farmers in the fields of naga 
Beliefs	They believed in veils, a collection of veils and talismans that the Nubians kept to rub them with. They painted them on the walls, or wrapped some of the talismans written on the cloth in the form of triangles and placed them under their clothes	Decorations portraying veils and talismans 
Nubian clothing	Each society has its distinctive character and expresses its culture and natural environment. In the country of Nubia, the woman is adorned with "Algargar," a famous women's dress Nubian	"Algargar" Nubian clothing for women in the old Nubia 
Ceremonies	One of the most important social events that show interaction and cultural diversity. A lot of traditional dancing and singing are practiced in these events; see figure	Traditional Nubian dancing 

Fig. 1 Settlements' pattern in old Nubia, with the villages being close to the Nile and bordered by agricultural lands

Fig. 2 Mosque in a Kenuz settlement

the house units in the form of dolls, fans, and veils, in addition to the paste ceramic dishes on the walls (Mahgoub 1990) (Table 3).

5 Nubian Migration

The people of Nubia were forced to evict their land several times through the twentieth century, at least four times in the period between the early 1900s–1964.

Fig. 3 Sailing boats (felukas) on the Nile

The first migration: The Aswan reservoir was constructed in 1902, which led to the submerging of few Nubian villages.
The second migration: The second reservoir's height was increased in 1912 and that led again to further submerging for some villages.
The third migration: The third raise was in 1933, which flooded many villages and reached the south until the country "Fadigga" and extended its influence until the valley of the alliance in Sudan, and migration to lands at higher levels.
The fourth migration: This came with the construction project of the high dam in 1964; see Fig. 9.

5.1 The Resettlement

Prior to the eviction, the government tried to come up with a conciliation plan for resettlement. Relocation sites were chosen by the government to be in Kom Ombo. The construction of new villages for the Nubians was set in the plan, and models for these villages were shown and displayed to Nubian people. Based on the interviews with the Nubians, some recall this period by saying it was a period of promises, where the government promised them compensation for their homes by giving them new homes in the new resettlement villages and good compensation for their palms.

The river Nile was scheduled to change course in the May 1964, as such the need to proceed with the resettlement was pressing. This was coupled at that time with an international campaign of saving the ancient Egyptian monuments in Nubia, an action that was led by the UNESCO as a coordinator between Egypt and the involved nations; see Fig. 10 (Scudder 2016).

Table 2 Residential units design

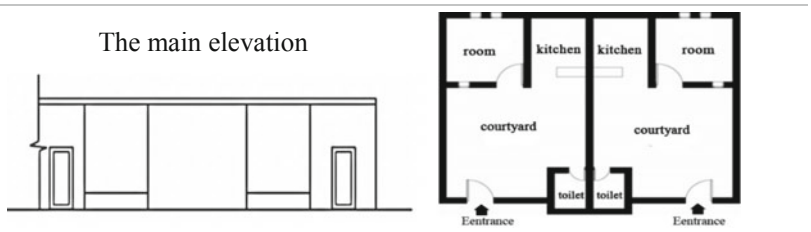
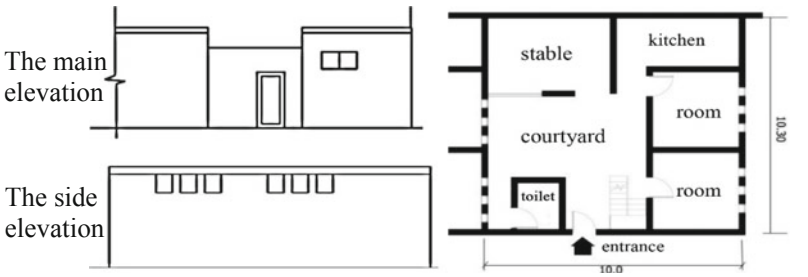
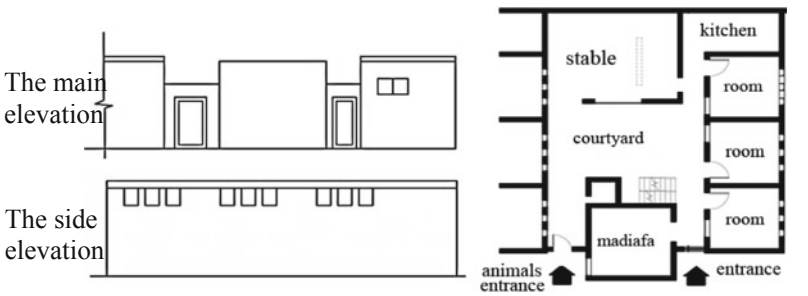
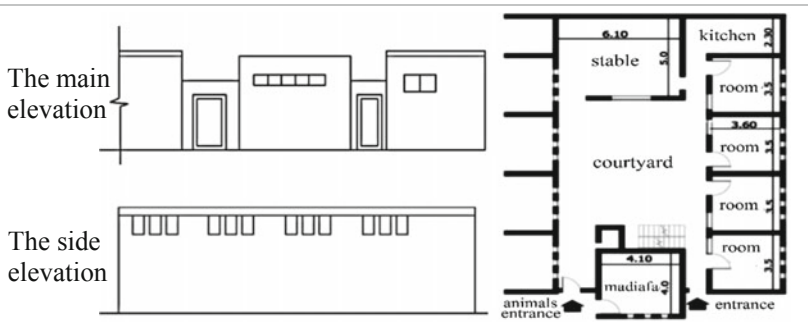
One-room-type house	This one-room-type house contained one room, a courtyard, a kitchen, and a toilet and used by small families of two members and single widows and bachelors	
Two-room-type house	The small house consisted of two rooms, a *madiafa*, a courtyard, a kitchen, a stable, and a toilet. The small house was to be used by families of less than five members	
Three-room-type house	The medium house consisted of three rooms, a *madiafa*, a courtyard, a kitchen, a stable, and a toilet. This type was to be used by families of five to seven members	
Four-room-type house	The large house consisted of four rooms, a *madiafa*, a courtyard, a kitchen, a stable, and a toilet. This type was to be used by large families which had seven or more members	

Fig. 4 Different types of the main entrance

Fig. 5 Different types of the madiafa

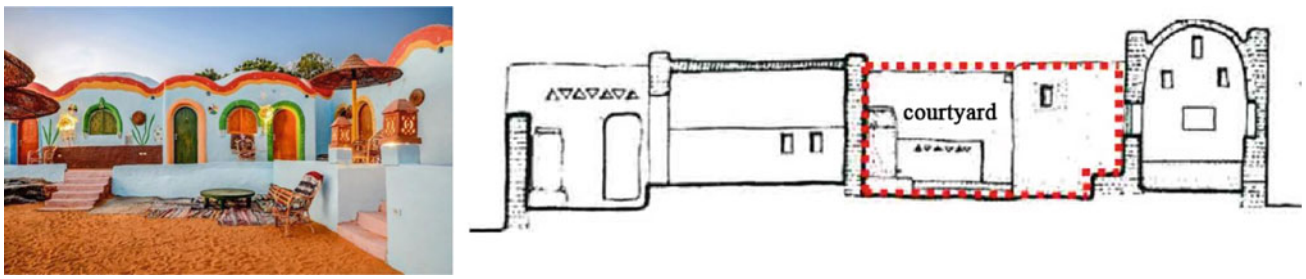


Fig. 6 Different types of the courtyards

Fig. 7 Different types of Al Takat

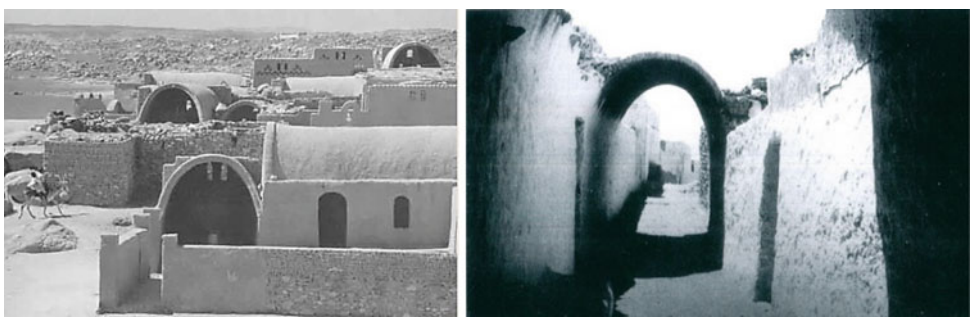


Fig. 8 Different types of the Nubian vaults

5.2 Example of the Residential Unit's Design to Settle the People of Nubia

The National Organization for the Dislocation of Nubians was established a set of recommendations for planning and designing the new villages. These guidelines stated that the houses should be identical using only three prototypes of design. The prototypes were designed according to the number of rooms in each type (Fahim 1974) (Table 4).

Table 3 Nubian decorations and its heritage and cultural meaning

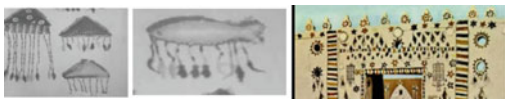
Decorative elements			Figures
Form	Description	Meaning	
Geometric forms	Triangular, circular, or cylindrical carvings	Protection of inhabitants from envy	
Semilunar star	Religious symbol from early Islamic ages	Religious holiness	
Religious and event drawings	Drawing of Holy Kaaba or camels convoys or weddings	Celebration of events	
Amulets	Urban legends: Amulets, Talisman, and special stones	Protection from envy, bad omens, and relapses	
Animals	A sort of bragging by hanging mummified animals over main entrance	Dominance	

Fig. 9 The eviction process in 1964 was done through Nile transportation

6 Applied Study

6.1 Global Area—Villages of "Thomas" and "Afia"

The villages of "Thomas" and "Afia" are considered to be one of the villages in the Nubian region of "Fadiga," now located on the western bank of the Nile, following the center of "Esna"–Qena. It is now inhabited by the Nubian families who were gentrified from the old Nubian region behind the high dam since June 1964 (Fig. 12).

The Nubians who chose Esna region were moved to a village named after the old village, followed by another two other villages. (Village 1, the middle village, Village 2); see Fig. 11.

The population of "Thomas" and "Afia" villages, according to statistics in 2006 to 5000 people, represents 977 families, including 2524 men and 2479 women.

6.2 Basics of Settlement of Families and Individuals in the New Villages, (Villages of Thomas and Afia)

The government built limited housing for families that were displaced from Nubia to Esna, and the settlement was based on the governmental inventory that was carried out prior to the construction of the high dam. The number of families is estimated to be about 200 families, and due to the absence of expatriates, who were out of Nubia during the inventory process, they were not given dwellings, "means that there

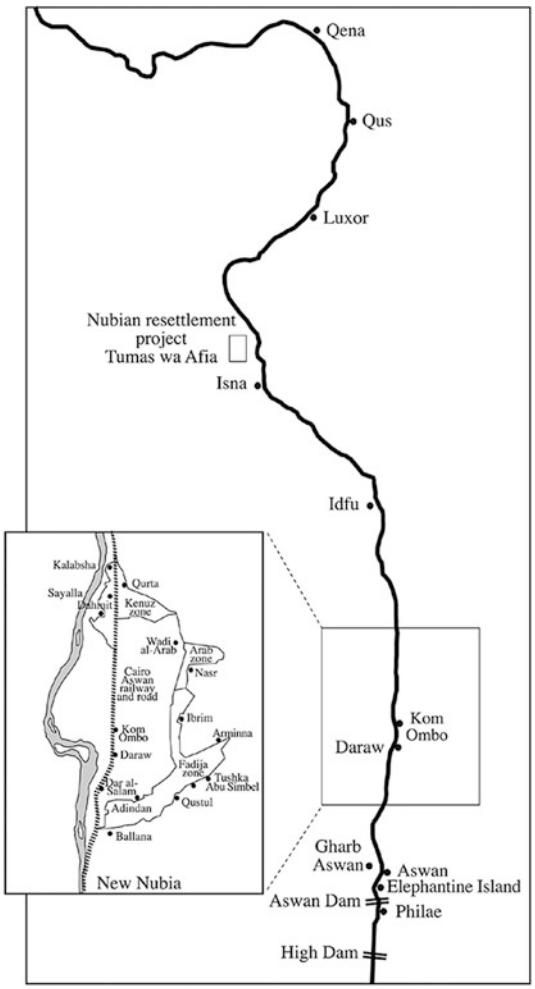


Fig. 10 New Nubia resettlement project locations

has been no intense stability for the sons of Thomas and Afia in Esna because there are no residences for expatriates." These dwellings were distributed according to the size of the family, and the residential models were also designed on this basis, not for considerations of social status or the area of the old dwelling or kinship ties; see Fig. 12 (Elhabashi 2014) (Table 5).

6.3 The Intimate Area—The Middle Village

The field study focuses on the middle village, one of the villages of Thomas and Afia, Esna, Qena, one of the villages of "Fadiga," who inhabited the southern part of old Nubian region. The study aims to detect and document the buildings' output of the village and track the examples of the official housing built by the state and another model built by self-effort to detect the urban and non-urban dimension and the interior and exterior changes of the building; see Fig. 13.

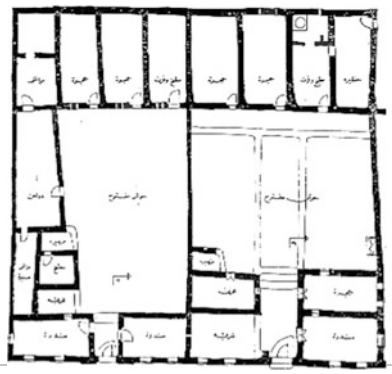
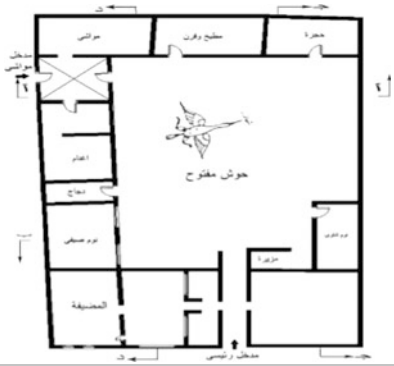
6.3.1 Village Master Plan (Form and Basic Features)

The region represents a complete residence that has its special nature as a result of the site circumstances and its determinants, which had a role in village constructional design. The village planning concept came as a routine instead of planning beside the Nile, and the village must be divided according to residential units area and not according to related links to the basic home, in which the residential units join from three sides to save spaces for constructing and save one elevation for every habitat to reduce roads surfaces in which the residential units became attached to each other's, see Fig. 14

6.4 Users Interference

The displacement of the human from his social environment that he is used to and grew up in, and cutting his firm and

Table 4 Different types of the Nubian housing

Example of Fadigga housing	Example of Kenuz housing	Example of El Arab housing
		
A residence in the village of Balana, one of the villages of the Nubians of Fadigga—Naga Ismailia in 1962	Maskan Ahmed Abidin, a resident of the village of Dahmit, one of the Kenuz villages 1962	Residential in the village of Qorta, one of the villages of the Arab region in 1962

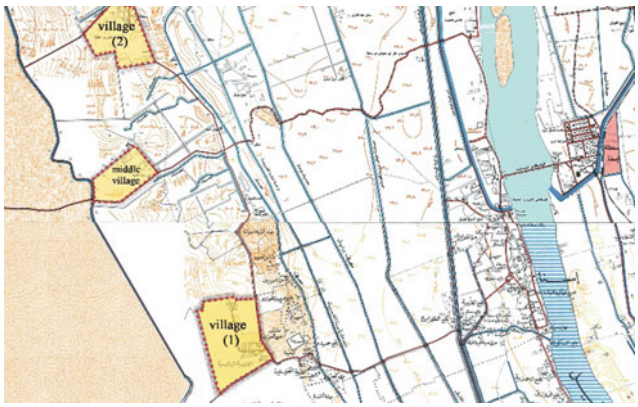


Fig. 11 Villages of "Thomas" and "Afia" in Esna

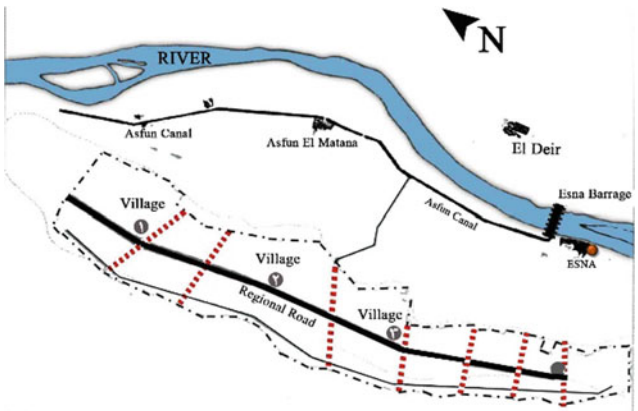


Fig. 12 Resettlement project at Esna

Table 5 Number of dwellings in villages of "Thomas" and "Afia"

Number of dwellings	Residential units				
	One room	Two rooms	Three rooms	Four rooms	Total
Residents	46	156	197	164	563
Expatriate	34	115	149	138	436

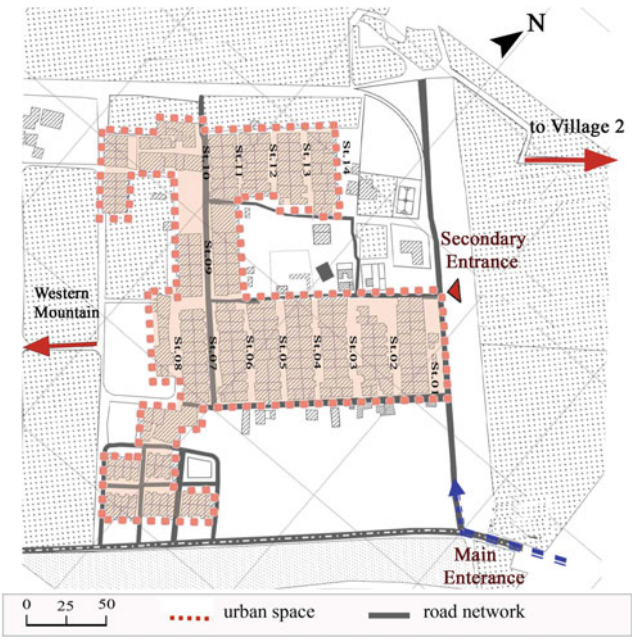


Fig. 13 Middle village master plan

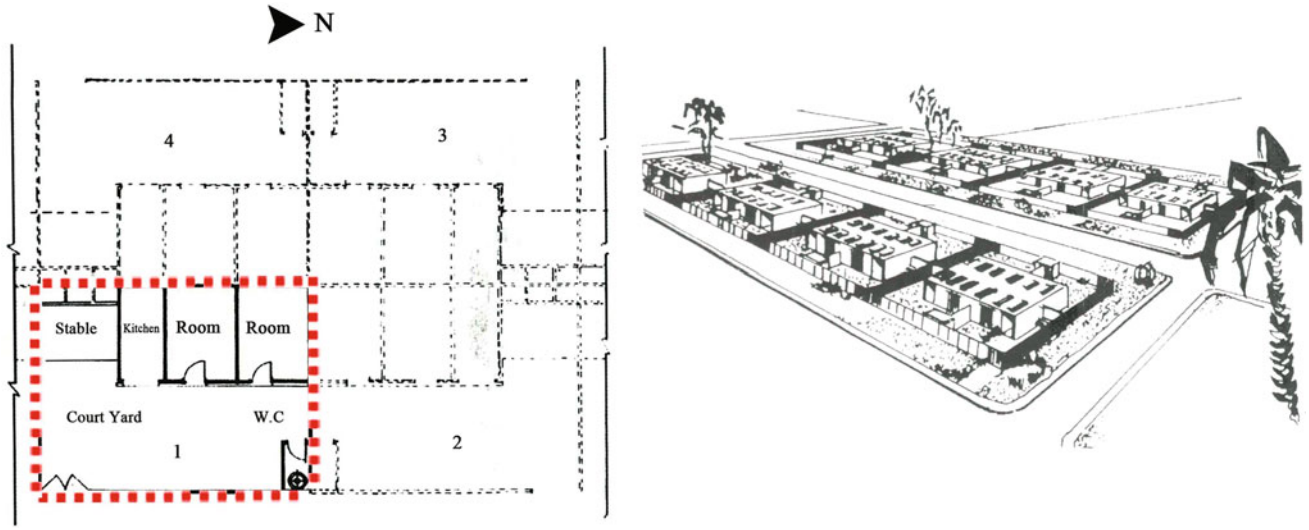


Fig. 14 Roomed pre-fabricated dwellings at Esna

well-established social roots and relocating him in a new environment different than the traditional Nubian personality, is not well studied either socially or humanity in new buildings with a new character.

Though 50 years passed since their immigration, they do not feel comfortable, which leads to making choices coming from their functional and communal needs (due to the immigration and the social situation change in the family and the increase of their needs and the change of the requirements). Alongside this, the architectural and urban interferences of the users in a time interval of 20 years were recorded focusing through the field surveying of the region on recording and analyzing two levels only: the interference on the level of the elevations and facades and the interference on the level of the residential unit due to the multiple changes done by the user to adapt with the new situation, so the relocated community started to make changes and modifications to the new residences built by the state, in order to make the human feel balanced, which is his ability to express himself, and the furthermost things expressed by the users are the inheritances surrounding him (Merdan 1990).

1. **The interference on the level of the facade**:

– Section line
– Colors and textures
– The buildings/property borders
– Skyline
– Rhythm
– Solid and void
– Ornaments and decorations
– Openings: Different door and window types—indoor and outdoor (Table 6).

2. **The interference on the level of residential unit**:

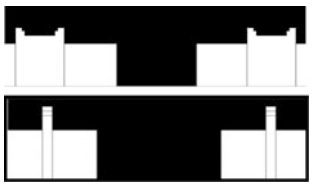
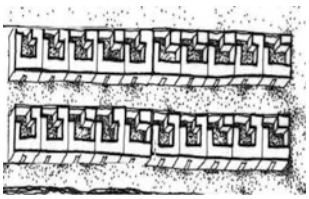
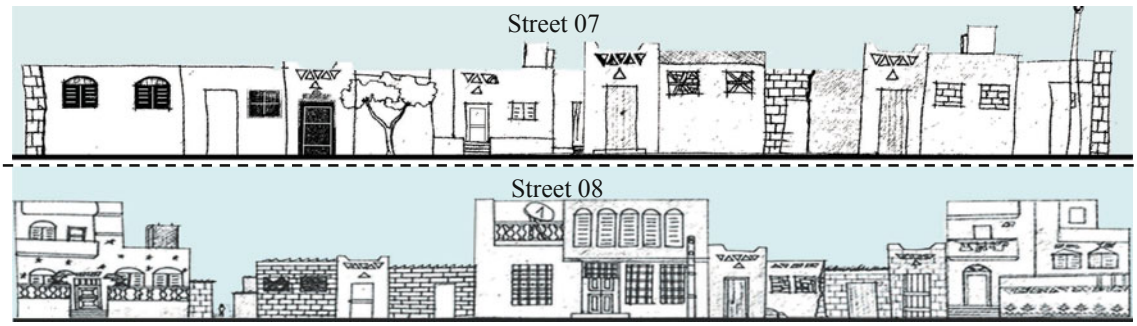
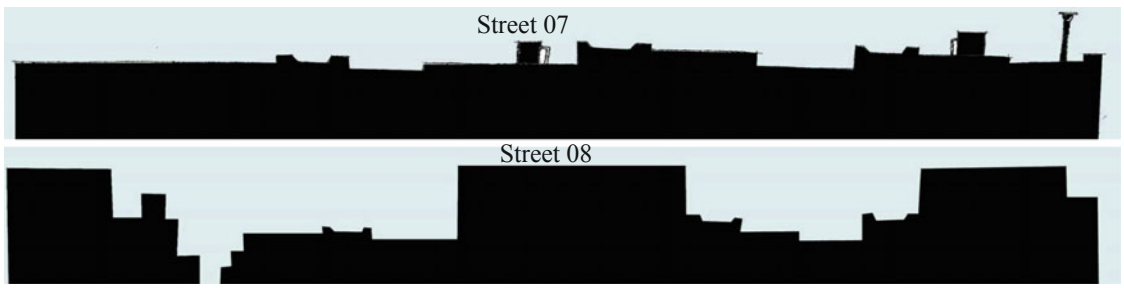
– Entrances
– Usage and activities inside the residence
– Environmental solutions
– Structural solutions
– Horizontal expansions/indoor and outdoor expansions (Table 7).

7 Conclusion

The research study reached the following conclusions:

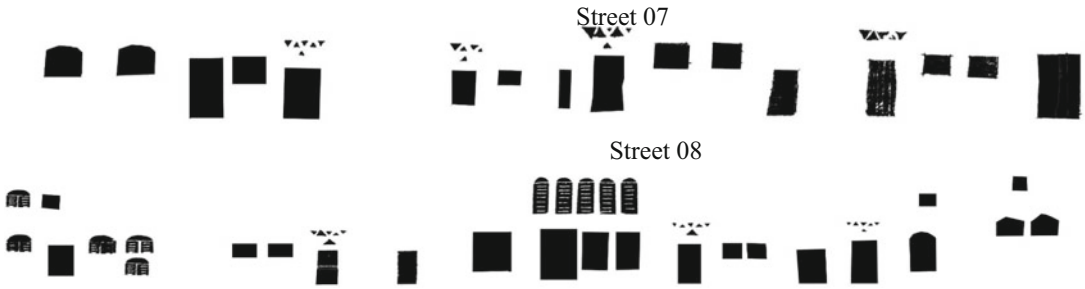
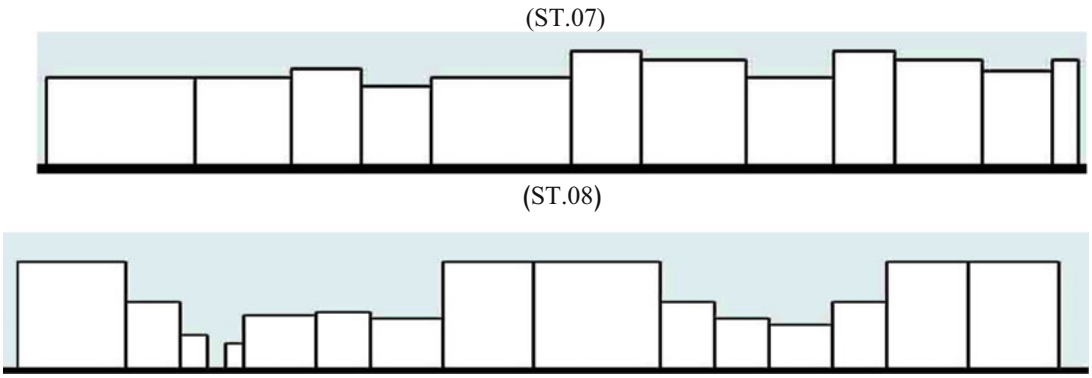
- The relation between the human and the environment is reciprocal: each affects and is affected by the other, and the result of this interaction expresses its cultural dimension, thus forming the architecture that forms the physical frame that includes the inhabitants.
- Traditional local heritage is a true mirror of the culture of the society across the ages, through its elements and its effect on the behavior, lifestyle, beliefs, and arts of people. It is also an inspiration for a lot of the heritage marks in architecture and building.
- The traditional building is considered the sum of knowledge, experimentation, and interaction with the

Table 6 Interference on the level of the facade

The interference	Original design 1964	Existing situation 2017	Notes
Colors and textures			White was the predominant color for Nubians in the old villages, but in the current situation (2017), the predominant color of the governmental housing after displacement is light yellow "beige" There is a variance in colors based on the owner's desire, unlike the traditional architecture of the traditional villages where white was predominant
Section line			There is a variation in section lines from street to another according to the different additions and horizontal and vertical extensions from one dwelling to another depending on the needs of each family and material capacity
The buildings/ property borders			In the case of displacement, the dwellings were similar and adjacent to each other. The situation changed because of the villagers' use of different treatments to determine the boundaries and ownership of their dwellings. The treatments include: (dwelling raising, dwelling color changing, corners raising, fence works, or landscaping) and vary according to the economic level of each family
The interference on the level of the façade (street 07 and street 08)			
Elevation			
Skyline			

(continued)

Table 6 (continued)

The interference	Original design 1964	Existing situation 2017	Notes
Solid and void			
Rhythm			
Ornaments and decorations			

(continued)

Table 6 (continued)

The interference	Original design 1964	Existing situation 2017	Notes
Different doors and windows			

surrounding context and reflects the response to the attempts to fulfill human requirements along the history of societies. Meanwhile, it is the true record of the culture of the society and its local heritage.

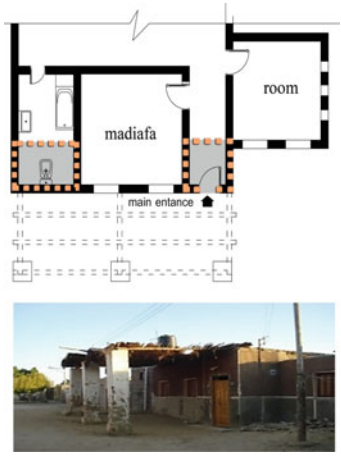
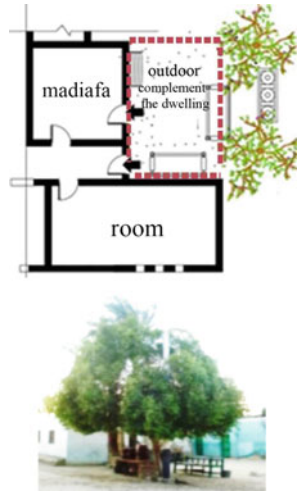
The results of the applied study:

- The Nubians were migrated in 1964 into villages different in nature and climate and houses with different designs from their original villages. The Nubians made several direct adjustments to the architecture of new villages to fit their physical and emotional needs.
- The field study used a simple design, multi-element methodology that aims to screen and monitor the interaction of the users with the new urban context in the new settlement villages for the Nubians (Thomas, Afia, and intermediate villages). The emigration was accompanied by an emotional emigration through different experiences and cultural and environmental values obtained from old Nubia, to which the Nubians firmly held, even if they contradicted with the pressures and definitions of the new place.

We summarize the results of this applied field study as follows:

- The change in the natural environment due to the migration from old Nubia to the new settlements was accompanied by a change in the activities and cultural and economic behavior of the society, which reflected directly on the characteristics of the Nubian personality and gave it new values: Instead of being ranked according to ethnic or familial origin, the financial ability and economic status became the main determinant of the social ranking.
- The unsuitability of the emigration villages and houses in general for the Nubian culture and habits: Its limited spaces did not fulfill the extended family needs. In addition, the division of the village into sectors, each including a standardized house model (one or two or three rooms) which were distributed according to the number of family members, without taking in consideration the degree of relation and the classic division of Nubian villages into "nagaaa" and residential communities based on related families. The basic units of the new Nubian community became the separate family with a separate house ending the role of the extended family that lived in a big house or multiple neighboring houses.
- The Nubians—despite all the negatives of the emigration and the different architectures of new villages—retained a lot of the aspects and details of their heritage special culture, habits, and traditions.

Table 7 Interference on the level of residential unit

	Interference type				Materials used	Interference			Reasons for interference	Sketches and illustrations
		Family	Builders	Artisans		Addition	Removal	Make a change		
Street 07	Entrances			●	Palm trees	●			Making an extension in the main facade, by increasing the entrance area and the bathroom to make a clear facade to make an outdoor shed in front of the entrance and using the added area as a seating place outside the residence and as a rest for the pedestrians from sun	
		●			White bricks and concrete	●			Making an extension the main room and a private entrance to the "Madiafa" outdoor and using the outdoor space resulting from the extension as an outdoor seating place and using the plantation element to provide shading to the place	

(continued)

Table 7 (continued)

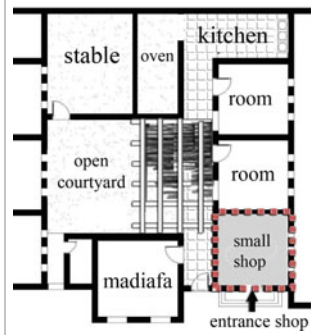
	Interference type				Materials used	Interference			Reasons for interference	Sketches and illustrations
		Family	Builders	Artisans		Addition	Removal	Make a change		
	Usage and activities inside the residence	●			White bricks and cement plaster			●	A house wife changed one of the residence rooms into a small shop to provide the family's financial needs by closing and canceling the indoor door to the room facing the main facade and opening another one to be an entrance to the shop	Original design 1964  Existing situation 2017 

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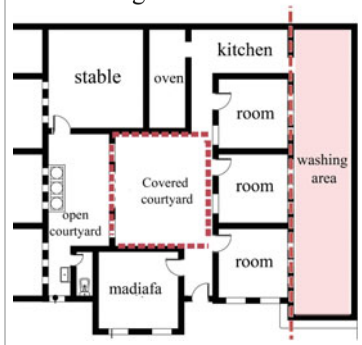
Table 7 (continued)

	Interference type				Materials used	Interference			Reasons for interference	Sketches and illustrations
		Family	Builders	Artisans		Addition	Removal	Make a change		
	Environmental solutions			●	Palm trees and wooden	●			Adding verandas to provide shade to parts of the court or shading the whole court to reduce the direct sun exposure and planting some shrubs into the middle of the court and painting the walls by white to reduce the rooms temperature	Original design 1964  Existing situation 2017 
	Structural solutions		●		Palm trees and wooden			●	Roofing the courtyard using the palm tree leaves and the wooden planks instead of RC	Existing situation 2017 

(continued)

Table 7 (continued)

	Interference type				Materials used	Interference			Reasons for interference	Sketches and illustrations
		Family	Builders	Artisans		Addition	Removal	Make a change		
	Horizontal expansions			●	White bricks and concrete and palm trees and wooden	●			– The people closed the upper windows to provide audio privacy – Dividing the indoor court to an exposed part and in exposed part and using the exposed one for guests instead of "Mazyara" – The bathroom was relocated next to the secondary entrance and the sewage wells were moved outside the residence	Original design 1964  Existing situation 2017 

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Evaluation of Applied Polymer Treatments for Egyptian Tura-Ma'sara and Mokattam Limestone Monuments

Hatem Tawfik Ahmed

Abstract

In order to repair and preserve weathered limestone architecture, sculptures, carved facades, and monuments, it is necessary to study the efficiency of treatments and the alteration mechanisms of physical and mechanical properties prior to their application in the field. In this chapter, we describe the results of a laboratory evaluation carried out on stone consolidants: silica-acid-ester (Wacker-OH), aliphatic-urethane resin (Z.K.F.), acrylate resin (ACR), and polymethyl methacrylate (PMMA), to ascertain the effectiveness of stone treatments applied on fresh Mokattam and Tura-Ma'sara limestone—extensively used in ancient Egypt (e.g., Saqqara and Giza Plateau). The studied limestones are of marine origin and are characterized by high porosity and relatively low strength. Observations and tests for assessing the performance of surface treatments include use of a scanning electron microscope (SEM) coupled with energy dispersive spectrometry (EDS); mechanical strength tests, such as uniaxial compressive strength tests (UCS), compared with Duroscope rebound values; rate of water vapor diffusion; and the use of hydrochloric acid to artificially age samples. The results provide important information for conservation and restoration work, helping design replacement material for historically damaged zones.

Keywords

Egypt • Mokattam • Tura • Limestone • Consolidation • Silica-acid-ester • Aliphatic-urethane resin • Acrylate resin • Paraloid B-72 • Uniaxial compression test • Scanning electronic microscope • Water vapor diffusion • Architecture • Monument • Sculpture • Ornament • Facade

1 Introduction

Limestone is a rock type that is widely used across the world and was one of the main building materials used in early ancient Egyptian dynastic times through to Graeco–Roman and Arabian times. The Egyptians found limestone to be an ideal material, exhibiting great variety, that was available along the entire length of the Nile Valley from Cairo extending south, far beyond Aswan. Easy access to it was facilitated by the Nile River. It was also found in the Eastern Desert. Mokattam and Tura-Ma'sara quarries were the main material sources in ancient Egypt, used for the construction of pyramids, temples and tombs, architectural reliefs and statues, decorative surfaces, and a variety of other carved objects (Ahmed 2004; Klemm and Klemm 2002; Bard 2005). Such usage of limestone reflects its easy workability, availability, and aesthetic qualities.

Despite the advantages of limestone's characteristics, composite limestone materials, especially if porous, are less durable and deteriorate over time, even if they are not exposed to outdoor environments (Siegesmund and Dürrast 2011; Jroundi et al. 2010; Grossi et al. 2012). Numerous Egyptian limestone sculptures, stored in different museums, have shown different patterns, and degrees, of decay. Such materials have generally experienced partial or complete loss of coherent detail (Bourguignon 2000).

Where limestone is severely damaged by weathering and other destructive physical, chemical, or biological processes, the use of alternative stone can solve problems in some architectural cases, but it may not represent the most desirable solution, particularly for ornamental facades and sculptural stones. In addition, the properties of raw materials, such as appearance, color, mechanical properties, are very

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different to weathered stone. This may result in dissimilar weathering patterns appearing in reconstructed architecture and monuments, something that might not manifest itself for many years (Přikryl 2007).

For these reasons, decisions about consolidation intervention may be necessary to prevent ancient and historical stonework degrading, and resist future decay, with the aim to make the stone as strong as it was originally (Doehne and Price 2010). Consequently, the evaluation of performance characteristics of stone consolidants is vital, and the degree of confidence (reliability) in the choice of the most optimal consolidation treatment depends on a series of procedures and technical questions, before a decision can be reached for consolidation of any historical architecture or ancient art stone object. Consolidants present the most difficulty to practitioners because of their associated complex interaction factors and requirements, coupled with their diverse evolutional mechanisms (Clifton 1980). In addition, the restoration of historical monuments has demonstrated certain concerns regarding the effects or alterations caused by former treatments (Ema et al. 2013), that have led to the damage of the surface layers, including changes in color and textural detail, of some monuments (Khallaf et al. 2011). Furthermore, of the many different products and treatments available on the market for stone monuments, statues, and architectural surfaces, each has its own advantages (Doehne and Price 2010) in terms of consolidating deteriorated stone.

In the context outlined earlier, this chapter deals with four commercial stone consolidants, frequently used in the field of historical limestone monuments (Doehne and Price 2010; Favaro et al. 2006; Oztiirk 1992; Zádor 1992). In order to evaluate their effectiveness and understand their mineralogical, physical, and mechanical properties, consideration is given to the measured improvements in chosen quarry samples after treatments. In addition, consideration will be given to the study of their deterioration behavior under artificial weathering.

A series of laboratory tests performed in order to evaluate the effectiveness of the consolidants was applied. The following methods were selected for their reliable and fast performance evaluation. (1) Uniaxial compressive strength (USC)—to evaluate the mechanical properties of the specimens before and after the application of consolidant and to measure the efficiency of consolidant products in terms of stone strength after consolidation, as well to study the deformation characteristics of stone samples. (2) Observations were made using a scanning electron microscope (SEM) coupled with energy dispersive spectrometry (EDS). An SEM allows direct observations to be made of surface morphology and porous structure both before and after consolidation, in order to determine the effectiveness of the dispersion and penetration of the consolidants in the structure of stone and its contribution to improvements to physical and mechanical properties. EDS focuses an electron beam in order to study the chemical composition of small particles. (3) Using a diluted solution of hydrochloric acid (known as muriatic acid), a simple test is used to analyze the reaction of the physical structure of both treated and untreated samples. This test helps with choosing a consolidation product for conserving typical limestone where decay is caused by the reaction of carbon dioxide in the atmosphere with water to form carbonic acid, H_2CO_3. (4) Water vapor permeability test—this is a measure of the passage of water vapor through a stone material. The experiment determines water vapor transmission rate before and after the use of consolidants—measuring the porous structure's permeability in terms of its potentially enhanced porosity after the use of consolidants.

1.1 General Goals

The goals of this study were to determine the performance of various commercial consolidant products on Tura-Ma'sara and Mokattam limestone and to evaluate their effectiveness with limestone belonging to the type used in ancient Egyptian monuments.

2 Materials and Methods

2.1 Stone Material

In the area of Cairo and Giza can be found Eocene limestone (on the eastern side of the Nile River). The region of Mokattam and Tura limestone quarries belongs to the lower to middle part of the Mokattam formation of the middle Eocene (Park and Shin 2009; Bard 2005). The Mokattam and Tura-Ma'sara quarries run along the entire region of the Giza Plateau to the escarpments of Sakkara on the west bank of the Nile River, belonging stratigraphically to the Mokattam group. This group is subdivided into a number of diverse members and facies, all of which belong to the upper Lutetian (Klemm and Klemm 2002). The Mokattam and Tura-Ma'sara formation might have been the main source of limestone rock used for architectural stone structures, ornaments, and sculptures in ancient Egypt, in the area of old Cairo in Islamic times (Park and Shin 2009).

Laboratory experiments were completed with the two different provenance limestone materials (i.e., from the Tura-Ma'sara and Mokattam quarries). The significance of Tura-Ma'sara and Mokattam limestone is that it was widely used throughout different Pharaonic periods in ancient Egypt for carving and the construction of architecture and sculptures (Plate 1). Such limestone was extensively used, e.g., in the Giza Plateau, a king's limestone statue was found in a small enclosed chamber on the north side of the pyramid—

The Great Sphinx of Giza is a large statue made of limestone on Giza Plateau, Egypt

A painted limestone statue of Egyptian Queen Hatshepsut in Egyptian Museum in Cairo.

An exquisite small limestone statue pair of Amenemipet and his wife, found at Saqqara.

Limestone stela Tomb of General Horemheb Dynasty XVIII

Tomb of General Horemheb Dynasty XVIII _ A statue room

Painted limestone Bust of Prince Ankh-Haf (h.50.5 cm) dating to the reign of Khafre, 4th Dynasty. Giza, tomb Museum of Fine Arts, Boston

Horemheb's, A finely executed limestone statue in the British Museum shows a seated couple dressed in their finest clothes.

Plate 1 Examples of the most important raw material used in ancient Egypt

now on display at the Cairo Museum (Bard 2007). Most of the core limestone for the three Giza pyramids, the outer layer of the pyramids of the old Kingdom, was faced with high-quality limestone, with a uniform light gray color and finer texture—originating from the Tura-Ma'sara quarries (Harrell 2008; Bard 2007).

For testing purposes, a block of stone of this material was freshly quarried and cut into 5-cm cubes. All the other necessary samples for laboratory testing were also obtained in readiness. The selection of the samples for the experiments was based on the "International Physical Qualification Standard."

2.2 Consolidant and Protective Products

The purpose of this study was to prove the effectiveness and applicability of four different commercial stone consolidants for use in the treatment of stone monuments fabricated from the original Mokattam and Tura quarries. Cubes (50 × 50 50 mm) of test specimens were obtained from substrata. The specimens selected and immersed on the following commercial stone consolidants for two cycles in the laboratory at a temperature of 20 ± 1 °C at constant mass. The organic products applied in the study included: silica-acid-ester (Wacker-OH), ready to use; Z.K.F., the

agent was aliphatic polyurethane, eliminating the need for dilution with white spirit "aromatic" (lakkbenzin) [Z.K.F. is a service patent of the Technical University of Budapest, created in collaboration with Dr. György Kollár, a chemical engineer; the procedure was purchased from German company Zádor and György (Zádor 1992)]; acrylate resin (ACR) diluted with white spirit (lakkbenzin); and (B-72) an acrylic resin polymethyl methacrylate copolymer (PMMA) diluted with nitro-thinner (nitrohigító). These consolidant products were selected according to their frequent use in the conservation of stone and historical monument materials.

Optimization of viscosity was necessary in terms of the penetration of consolidants; therefore, fluid viscosity (measured in millipascal-seconds, mPa s) measurements were an important factor considered when dispersing the consolidants into the porous structure of the limestone samples to improve their physical and mechanical properties. Consolidant viscosity was measured using calibrated digital viscometers (DV-P series; Ahmed et al. 2006).

2.3 SEM Micrographs and EDS Spectra

Scanning electron microscope and EDS analyses provided information concerning the changes in stone surface morphology after treatment with the polymers. The scanning electron microscope used was a JEOL 5410, equipped with an energy dispersive spectrometer (EDS; Voyager 3100, NORAN). EDS analysis provides accurate information about the chemical composition of minerals.

2.4 Mechanical Characterization

Mechanical properties reflect the effect of consolidation treatment on the internal cohesion of the stone matrix and the adhesion between stone constituents. Uniaxial compressive strength (σc) is one of the most important mechanical properties of rocks (Moomivand 2011; Çobanoğlu and Çelik 2008; Sharma and Singh 2007). It is widely used to understand and characterize the potential behavior of a rock mass under dynamic and static load (Ozturk and Nasuf 2013; Das and Paul 2006; Mishra and Basu 2013). Uniaxial compressive strength test specimens experience longitudinal stress, determining their maximum values to failure (Siegesmund and Dürrast 2011; Anania et al. 2012)

The mechanical characterization of the test specimens was carried out on dry cubes (50 × 50 × 50 mm) obtained from the Mokattam and Tura-Ma'sara quarries. The procedure for measuring the strength of the specimens was performed on five specimens of each consolidant and five specimens of untreated samples, from each of the sample sites, in order to identify the modification of strength after treatment and determine the full behavior of each product under compression. The procedure for measuring the strength of the specimens was carried out in a dry laboratory environment.

2.5 Hydrochloric Acid

Corrosion and dissolving minerals of carbonate materials may be caused by acid rain and high humidity conditions in polluted urban and industrial atmospheres. Therefore, limestone monuments, statues, carved facades, and other architectural limestone structures are susceptible to varying degrees of damage and decay.

Acidic deposition was simulated in the laboratory by soaking specimens in a 10% dilute solution of hydrochloric acid (known as muriatic acid) to assess the performance of surface treatments, thereby affecting the durability of stone monuments. Tests were completed for each consolidant group on square-shaped 5 × 5 cm specimens having a thickness of 1 cm, as well as on untreated specimens. The disintegration resulting from this (CHL) simulation can be used to understand the relationship between rock formation (mineral composition, grain homogeneity, stone fabric, and structure) and the performance of the applied consolidant. The test also highlighted the relationships between the textural, compositional, and strength parameters of the limestone monuments and their decay.

2.6 Water Vapor Diffusion

Vapor diffusion is a moisture transport phenomenon based on water vapor concentration or the difference of partial pressure through stone materials. The diffusion of moisture is a natural phenomenon. This phenomenon plays an important role in the overall moisture management and durability of stone monuments (Togkalidou et al. 2013)

Water vapor diffusion experiments were carried out in the laboratory in order to assess the vapor permeability of building materials. The test involved cutting one cube for each treated group into four slides, with uniform square shape (5 × 5 × 1 cm in thickness). The sides of the samples were then sealed with silicone rubber to allow water vapor to flow in one direction only. This experiment was completed for treated and untreated samples. Each of the specimens were placed in closed glass vessels, specifically designed for water vapor transmission (impermeable to water vapor), containing a suitable humidity sensor. Each glass vessel contained 100 mL of deionized water positioned 60 mm from the specimen throughout the entire experiment. The vessels were then placed in a chamber that permitted holding the temperature at 22 ± 1 °C. The assessment was based on

the mass measurement of water vapor passing through sample surfaces under a known partial pressure drop. The water vapor permeability rate was evaluated as the mass of water vapor passing through the surface in unit time (24 h), and was weighed periodically for 18 days. The relative humidity (RH) inside the glass vessel was recorded each time the mass samples were measured.

3 Results and Discussion

SEM examination displayed variation and contrast between the multiscale grains and porosity of the Mokattam limestone and the compactness of the Tura-Ma'sara limestone. It was notable that SEM macroscopic observations revealed good detail in the Mokattam and Tura-Ma'sara limestone samples, allowing observations of features such as homogeneous structure, pore distribution and volume, and the presence of altered calcite grains. In addition, observations showed variation in the surface texture and chemical interaction behavior after the application of silica-acid-ester (Wacker-OH), aliphatic-urethane resin (Z.K.F.), polymethyl methacrylate (PMMA), and acrylate resin (ACR). The results of the examination revealed differences in the penetration of the polymer treatment sealing films and highlighted differences in sealing performance on Tura-Ma'sara and Mokattam limestone (Plates 2, 3, 4, 5, 6, 7, 8 and 9). Wacker-OH displayed, under different magnification (Plate 2), a cured polymer film with Tura-Ma'sara samples with important modifications noted in the internal structure and have meso-pores distribution. For acrylate, in terms of product sealing (Plates 5 and 9), magnified observations showed that the polymer film did not cover all grains. On the samples treated with Z.K.F. consolidant (Plates 4 and 8), a change of surface morphology was observed, with a network of polymer observed on pore surfaces. Paraloid B-72 consolidant (Plates 3 and 7) showed a uniform coating of stone particles, mainly concentrated on the sample surface.

EDS spectrum analysis revealed the chemical composition of Egyptian Tura-Ma'sara and Mokattam limestone (Figs. 1 and 2). Their compositions were mainly of calcite (calcium carbonate, $CaCO_3$) with some dolomite (calcium–magnesium carbonate $CaMg(CO_3)_2$), quartz (silica, SiO_2), traces of iron oxides (haematite, Fe_2O_3, or goethite, $HFeO_2$), and a small amount of clay and other minerals.

It was expected that the structure of the stone samples after treatment with consolidating materials would become more resistant to weathering. The results of using hydrochloric acid as a means of artificial aging showed a dissolving of minerals and a loosening of stone coherence. The selected specimens caused rapid bubble action after being soaked in the HCl solution (Fig. 3). This may have been due to the acid reaction with carbonate minerals such as calcite ($CaCO_3$) or dolomite $CaMg(CO_3)_2$. Comparing the values and effectiveness of polymers for Tura-Ma'sara and Mokattam limestone (Figs. 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13) revealed the mechanism, by which minerals and stone structures are affected by HCl. Such a solution loosens sample integrity and causes the disappearance of binding materials due to the process of dissolving minerals, coherent materials, and organic substances. In addition, such reactions with treated surfaces may be related to the behavior of the polymer—progressively reducing its protective value. Samples of Tura-Ma'sara and Mokattam, treated with acrylate stone consolidant, showed complete disintegration (Figs. 5 and 10) and the roughness behavior and erosion mechanism on untreated surfaces of Mokattam samples were very different from treated samples (Fig. 9). The reaction of Mokattam samples treated by acrylate and Z.K.F. consolidants showed deep cavities forming in some areas with aggressive erosion (Figs. 10 and 13). The result may have been due to the formation of consolidants into binding grains and their dispersal within the stone structure. According to Torraca, such a process, when a cavity is formed on the surface of a monument, occurs when evaporation takes place rapidly below the surface in the pores or when evaporation occurs more rapidly in one area than another (Torraca 2009).

The Wacker-OH consolidant revealed positive results in some areas with Mokattam samples. It also showed perforation and damage in different areas of the same samples

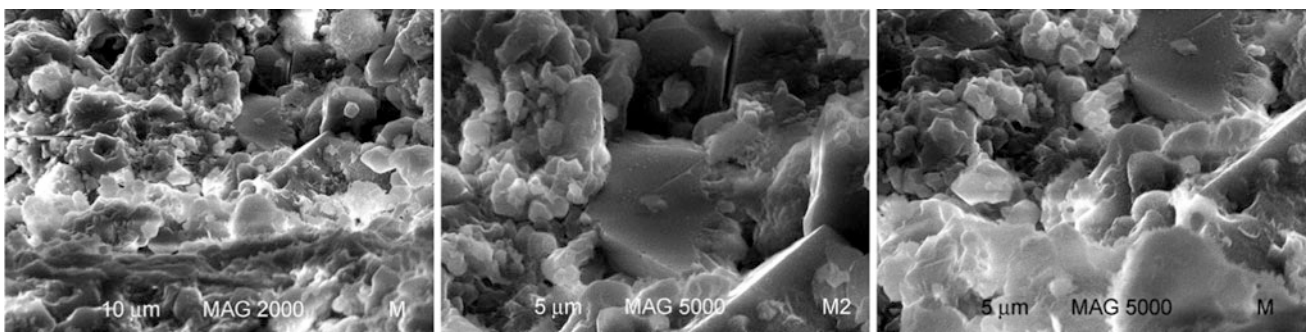

Plate 2 SEM images with different magnifications of Tura limestone treated with W-OH

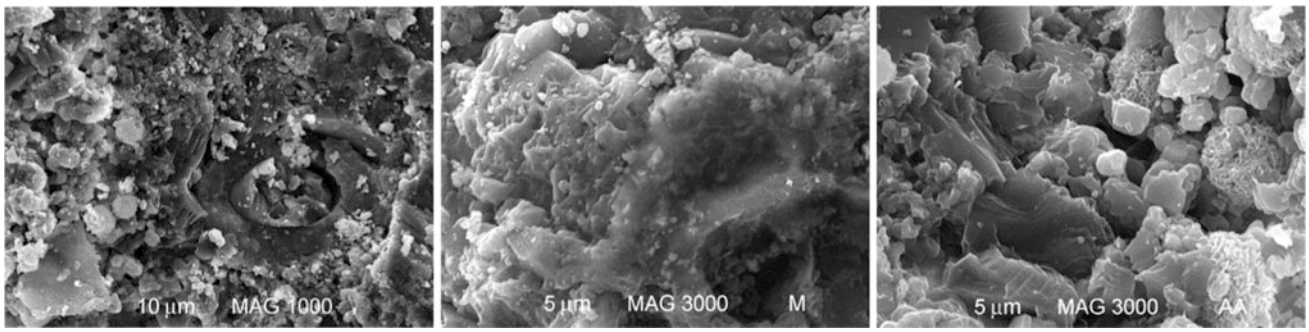

Plate 3 SEM images with different magnifications of Tura limestone treated with B-72

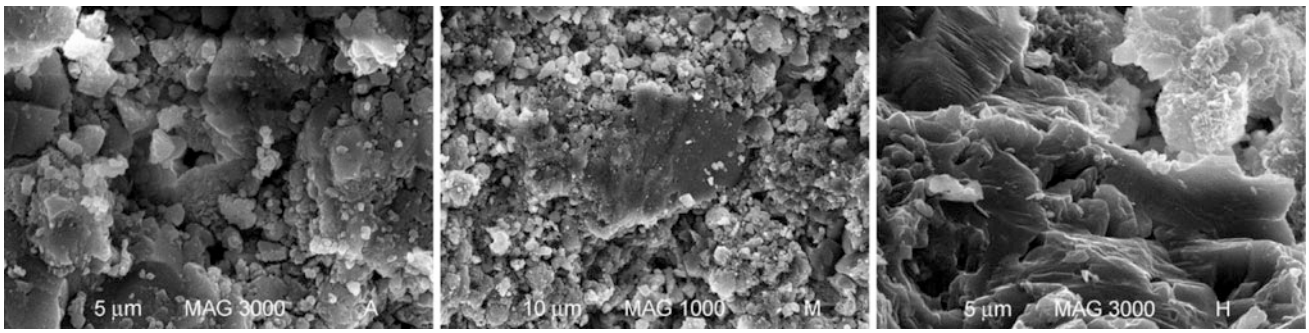

Plate 4 SEM images with different magnifications of Tura limestone treated with Z.K.F.

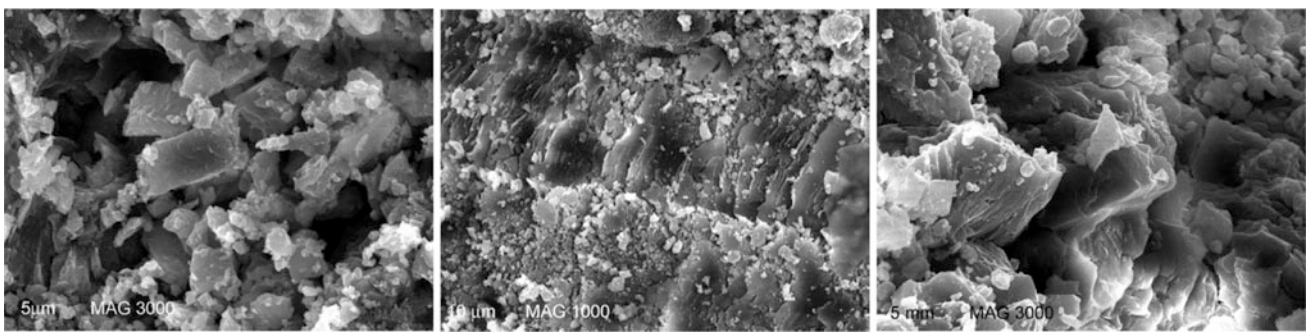

Plate 5 SEM images with different magnifications of Tura limestone treated with acrylate

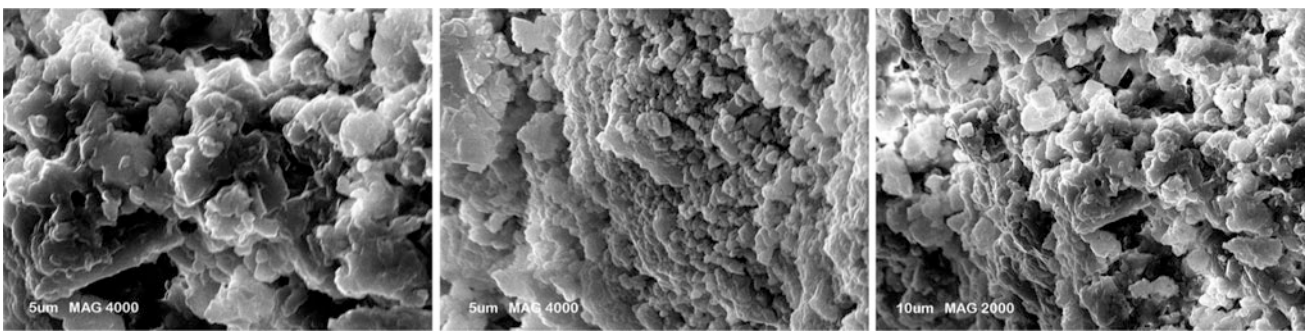

Plate 6 SEM images with different magnifications of Mokattam limestone treated with W-OH

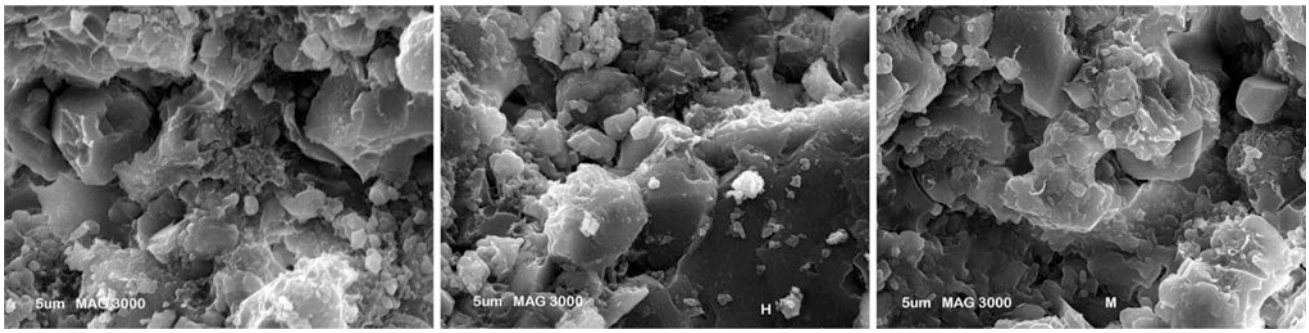

Plate 7 SEM images with different magnifications of Mokattam limestone treated with B-72

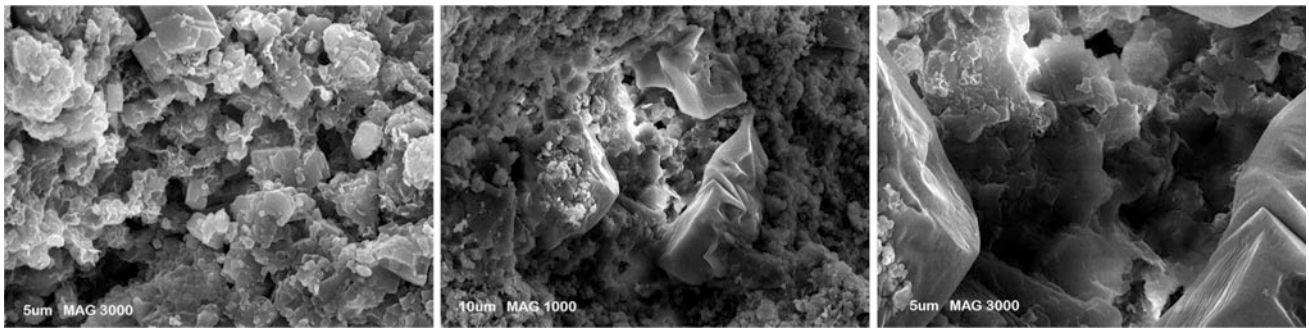

Plate 8 SEM images with different magnifications of Mokattam limestone treated with Z.K.F.

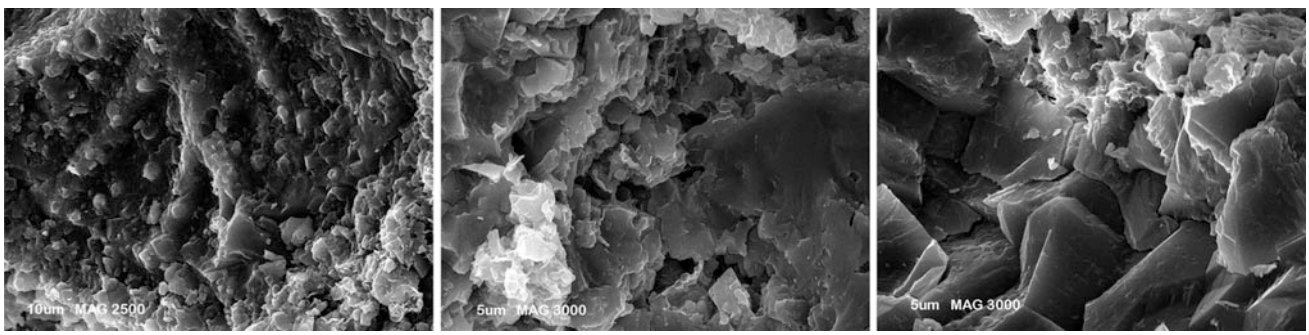

Plate 9 SEM images with different magnifications of Mokattam limestone treated with acrylate

(Fig. 12). The erosion characteristics of samples of Mokattam treated with W-OH may be due to the chemical composition and limestone fabric structure as well as consolidant behavior. Paraloid-72 (Fig. 11) showed different behavior in terms of its reaction with the surface of Mokattam samples, offering more protection than other polymers. Regarding Duroscope rebound results (Ahmed et al. 2006), Mokattam samples with B-72 revealed higher strength surface values, perhaps correlated with Paraloid-72 penetration and evaporation behavior.

Comparing treated Tura-Ma'sara samples (Figs. 4 and 8) and untreated samples (Fig. 4) shows somewhat similar erosion behavior, but treated samples are more durable compared with the erosion times of untreated samples. The result may be due to the natural stone fabric of Tura-Ma'sara being more compact and durable than Mokattam, which is more porous. Z.K.F. consolidant (Fig. 8) revealed better results in terms of surface protection, followed Wacker-OH (Fig. 7), compared with B-72 (Fig. 6) and acrylate (Fig. 5), which revealed a loosening of outer areas. Generally, the

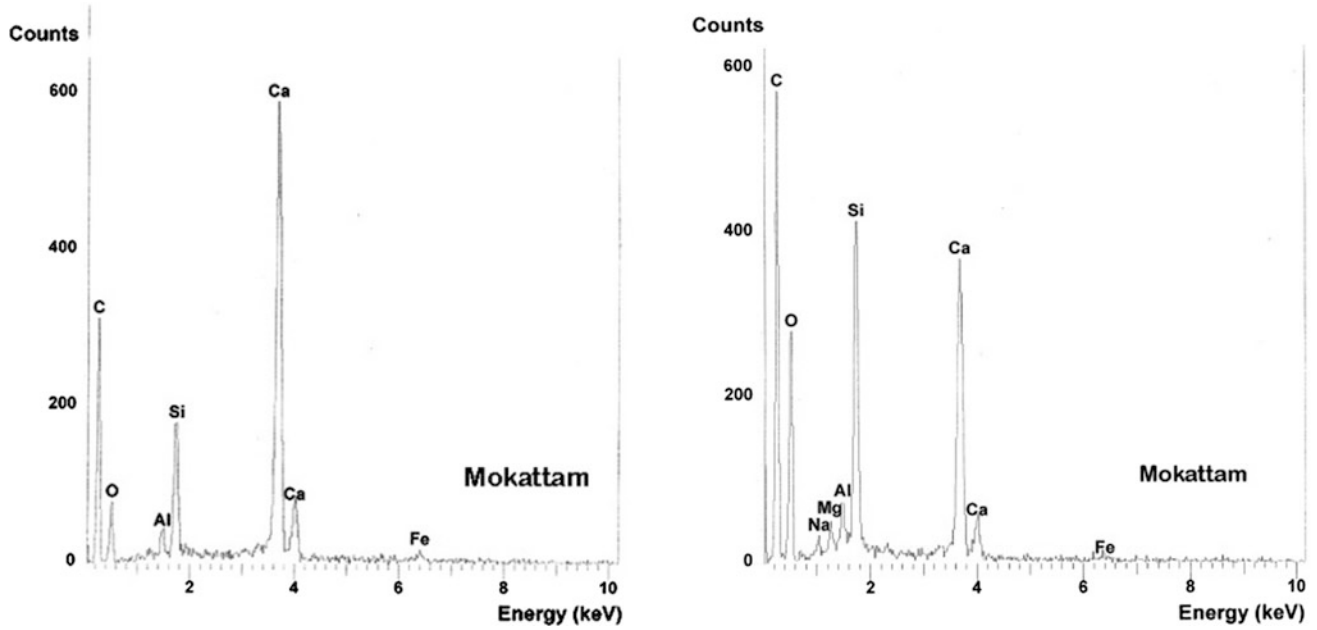

Fig. 1 EDS spectrum analysis of Mokattam limestone

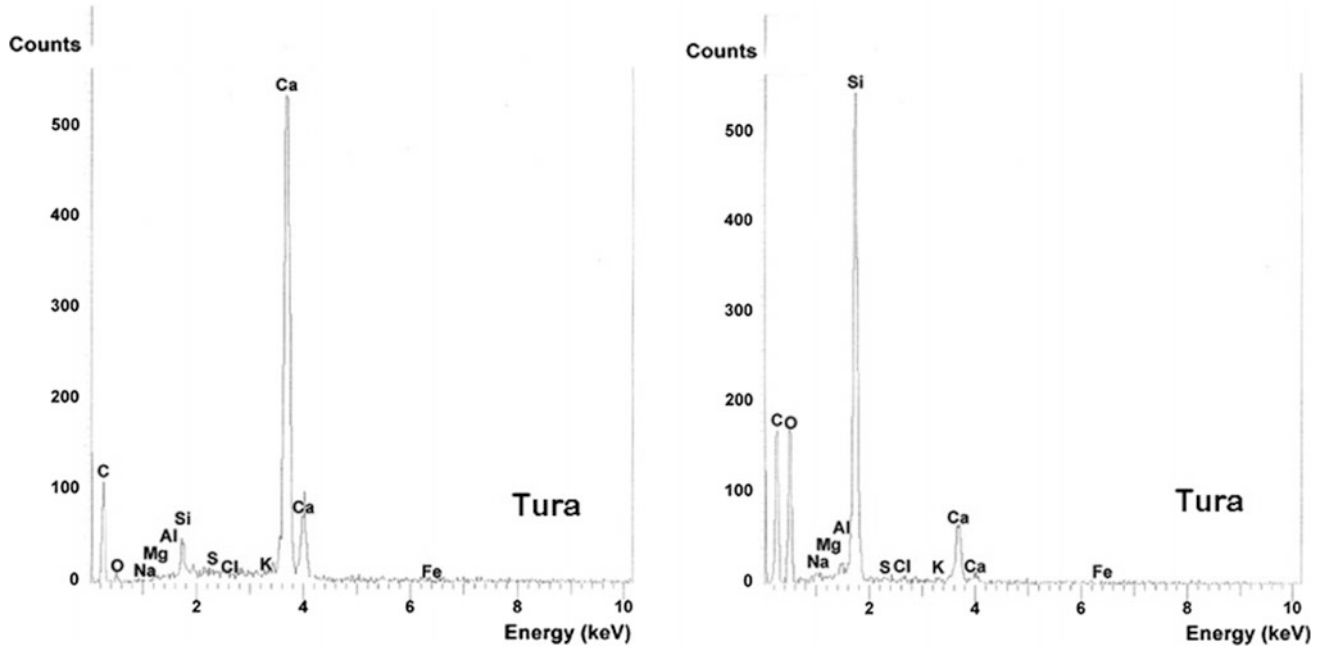

Fig. 2 EDS spectrum analysis of Tura limestone

Fig. 3 Acid reactions after the immersion of limestone samples

Fig. 4 Erosion characteristics of untreated Tura-Ma'sara limestone samples after (CHL) artificial aging

Fig. 5 Erosion characteristics of acrylate-treated Tura-Ma'sara samples after (CHL) artificial aging

Fig. 6 Erosion characteristics of B-72-treated Tura-Ma'sara limestone samples after (CHL) artificial aging

reaction mechanism in Tura-Ma'sara limestone specimens showed single alveoli that developed from the sides of the samples causing a loosening of substances in the outer areas of samples.

Evaluation of water vapor transmission revealed, with reference to untreated samples, no significant reduction of water vapor permeability rates for samples treated using the different polymers (Table 1). This result highlights the

Fig. 7 Erosion characteristics of Wacker-OH-treated Tura-Ma'sara samples after (CHL) artificial aging

Fig. 8 Erosion characteristics of Z.K.F.-treated Tura-Ma'sara samples after (CHL) artificial aging

Fig. 9 Erosion characteristics of untreated Mokattam limestone samples after (CHL) artificial aging

advantageous behavior of products that do not seal structural pores. The driving pressure of the water vapor flow remained constant throughout the experiment for the first 4 days in the Mokattam samples (Fig. 15), both treated and untreated. Z.K.F. and Wacker-OH consolidants revealed permeability rates that remained constant to the end of the experiment. The vapor permeability with Tura-Ma'sara reveals a constant change in the absorption behavior with acrylate and B-72 over a period of 10 days (Fig. 14), whereas with Z.K.F. and W-OH the permeability was quite constant. The relative humidity

Fig. 10 Erosion characteristics of acrylate-treated Mokattam samples after (CHL) artificial aging

Fig. 11 Erosion characteristics of B-72-treated Mokattam limestone samples after (CHL) artificial aging

Fig. 12 Erosion characteristics of Wacker-OH-treated Mokattam samples after (CHL) artificial aging

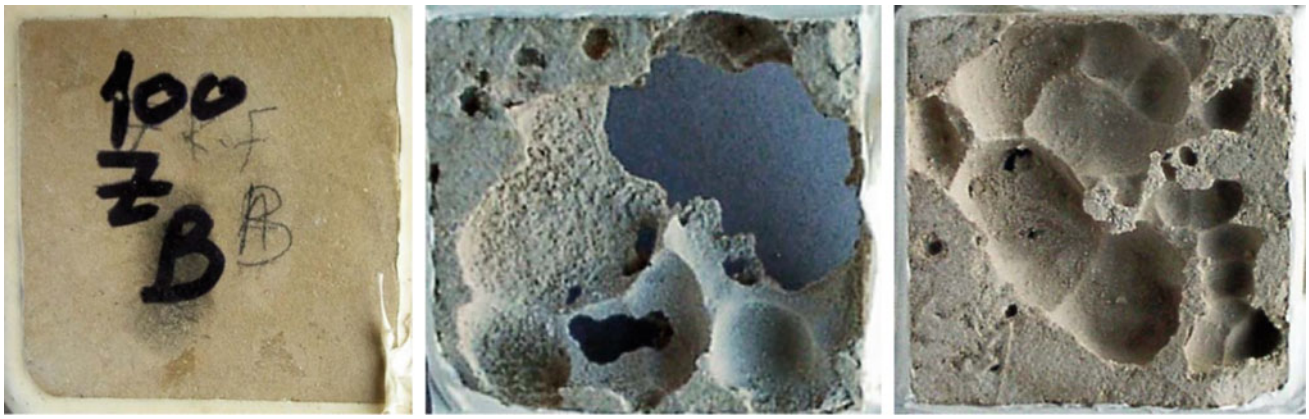

Fig. 13 Erosion characteristics of Z.K.F.-treated Mokattam limestone samples after (CHL) artificial aging

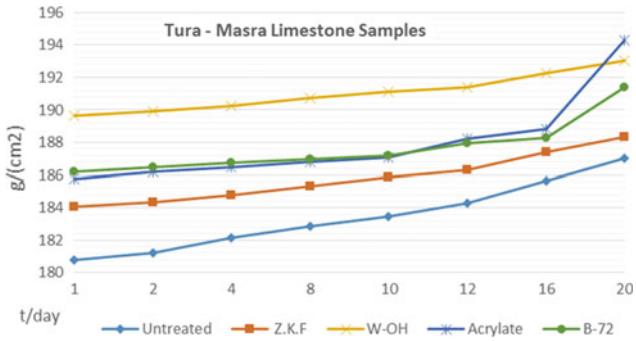

Fig. 14 Behavior of water vapor flow in treated and untreated Tura-Ma'sara limestone

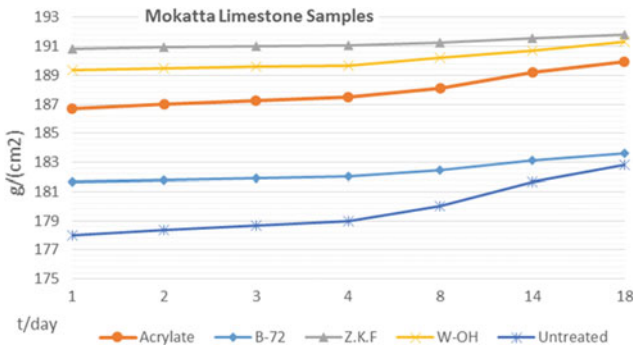

Fig. 15 Behavior of water vapor flow in Tura-Mokattam limestone

(RH) inside the glass vessel was a variable, from 72 RH on the first day of the experiment, to 91 RH on the last day, helping to interpret the differences in absorption rate after the first 4 days. It was notable that Mokattam limestone is more porous than Tura limestone; however, the water vapor transmission rates are higher in Tura samples (Table 1).

The results of the mechanical properties of treated and untreated Tura-Ma'sara and Mokattam limestone samples (Plates 10 and 11), using uniaxial compressive strength, revealed linear elastic and average (megapascal) values with differences in behavior that ultimately led to total material failure through increased micro-crack formation. By comparing treated and untreated Tura-Ma'sara and Mokattam limestone samples, tests found that the strength values increased for all products. This can be attributed to polymer penetration into the stone structure. Moreover, results revealed Z.K.F. and Paraloid-72, when applied to Mokattam samples, provided better uniaxial strength than W-OH. With reference to untreated samples, acrylate showed improvement in strength compared with untreated samples but revealed the lowest strength values compared with other products. Considering the values and effectiveness of the behavior of the tested polymers with Tura-Ma'sara limestone samples, those treated with Z.K.F. showed a notable effectiveness in terms of strength compared with untreated samples. Paraloid-72 and Wacker-OH revealed similar values. The values and effectiveness of acrylate with Tura-Ma'sara stone samples revealed similar behavior in terms of material failure and micro-crack characteristics as those for Mokattam samples.

Studies on the conservation of historical stone monuments using consolidation have proved that there is a relationship between strength and viscosity that they offer excellent bonding properties (Oliveira 2005; Calia et al. 2012). Whereas our experiment shows the effectiveness of the uniaxial compressive strength test (UCT) using Paraloid-72 and silica-acid-ester (Wacker-OH) are similar, whereas viscosity of B-72 (9.3 mPa s) with (0.8460) density while (2.8 mPa s) viscosity with silica-acid-ester (W-OH) and (0.9793) density, as Z.K.F. have (2.5 mPa s) viscosity and (0.8370) density (Ahmed et al. 2006). The effectiveness value of limestone strength experiments proves that the effectiveness of strength may not be attributed to viscosity alone, but may refer to polymer density and may be

Table 1 Water vapor permeability rate

Tura-Ma'sara samples	Average permeability rate (%)	Mokattam samples	Average permeability rate (%)
Untreated samples	14.95	Untreated samples	12.53
Treated with W-OH	15.21	Treated with W-OH	12.14
Treated with B-72	14.57	Treated with B-72	12.52
Treated with Z.K.F.	14.95	Treated with Z.K.F.	12.41
Treated with acrylate	14.91	Treated with acrylate	12.21

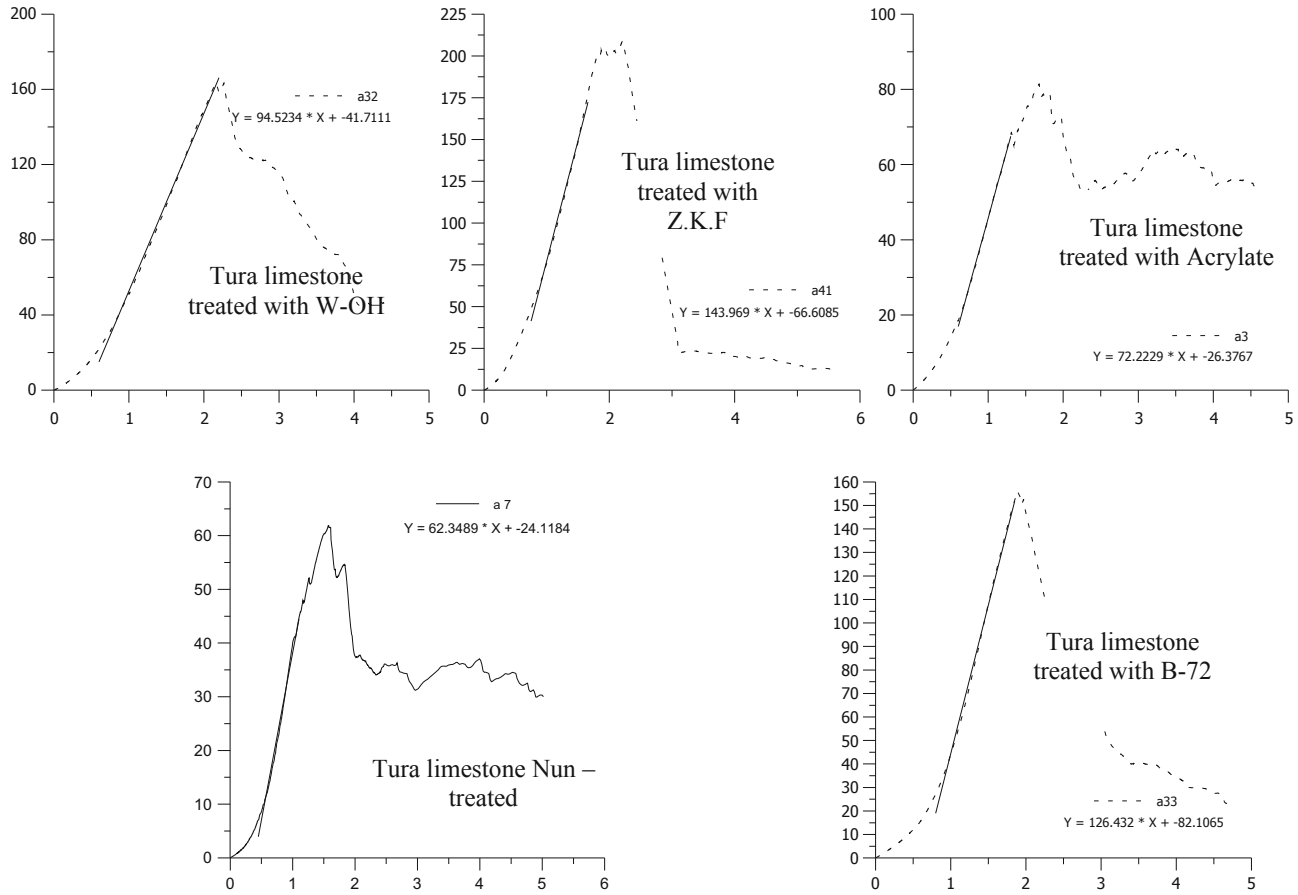

Plate 10 The uniaxial compressive strength test (UCT) of Egyptian Tura limestone shows a nearly linear elastic behavior and ultimately leads to total material failure by increased micro-crack formation

attributed as well to the compatibility, homogeneity, and chemical composition of limestone.

Comparing uniaxial compressive strength results with Duroscope rebound values for Mokattam limestone (Ahmed et al. 2006), proves that aliphatic-urethane resin (Z.K.F.) has the highest value of strength, followed by polymethyl methacrylate (B-72) and silica-acid-ester (Wacker-OH), whereas acrylate resin offered the least effective value of strength as revealed in UCS experiments. In our tests, Tura Ma'sara limestone combined with Wacker-OH had the highest value of strength, followed by aliphatic-urethane resin (Z.K.F.), then polymethyl methacrylate (B-72)—acrylate resin having the least strength value compared with other applied polymers.

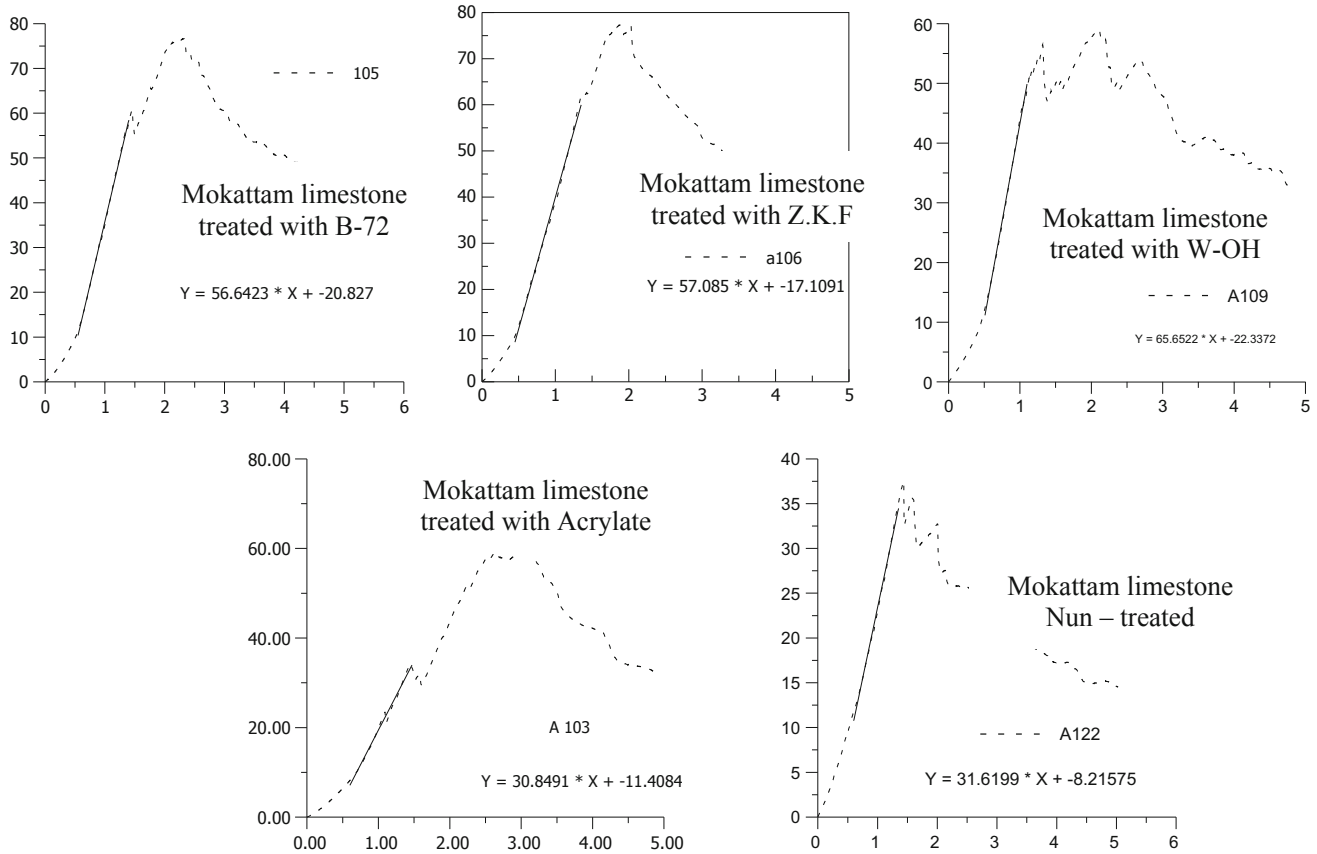

Plate 11 The uniaxial compressive strength test (UCT) of Egyptian Mokattam limestone shows a nearly linear elastic behavior and ultimately leads to total material failure by increased micro-crack formation

4 Conclusions

The study assessed and compared the effectiveness of certain consolidants: silica-acid-ester (Wacker-OH), aliphatic-urethane resin (Z.K.F.); polymethyl methacrylate (PMMA); and acrylate resin (ACR). Observations using a scanning electron microscopy (SEM), coupled with energy-dispersive spectrometry (EDS), provided sufficient information concerning the chemical composition of minerals, texture variation, and chemical interaction behavior subsequent to product application. Treatments modified the microstructural characteristics of the samples according to limestone type.

The present work allows quantification of the efficiency of stone consolidants for use as treatments for limestone monuments, statues, carved facades, and other architectural structures fabricated from Tura-Ma'sara and Mokattam limestone. The application of tested consolidants suggests they can improve the strength of architectural structures and monuments as well as structural integrity. Tests revealed there was no absolutely preferable consolidant suitable for all types of deterioration. The various experiments and simulations revealed that consolidants should be selected after examining a number of properties prior to their application to historical monuments—consideration should also be given to monument stone type. The study (CHL) of artificial ageing suggests we should take into consideration progressive deterioration before any treatment as well as understanding stone consolidant behavior prior to treatment. It is important to note that the mineralogical content of stone types is often similar but different environments may require different treatments.

The study proved that choice of any recommended material can only be made after laboratory tests to ascertain what product and technique will provide the most satisfactory improvement to the resistance of a stone type, while offering the fewest drawbacks. Therefore, the selection of consolidant material and application method to architecture and limestone monuments must be tailored to criteria such as:

- Precise diagnosis and identification of physical and mechanical properties.
- Identification and classification of destructive factors.
- Consolidant use should be unique to individual historical monuments.
- Cleaning test in order to evaluate the procedures of stone decay

Comparing results from the Duroscope rebound values (Ahmed et al. 2006) with the uniaxial compressive strength test (UCT) revealed a correlation with a degree of confidence (reliability), representing a good indicator for investigating the exposed surface strength of historical architecture and monuments to various weathering forms. The advantage of the Duroscope rebound is its nondestructive nature, providing as many indicator points as necessary. On the other hand, it cannot show the elastic linear properties and the material failure behavior revealed by UCT.

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Correction to: Reviving Sudan's Ancient History and Tourism

Alaa Abbas, Fatimah Abbas, and Aida Nayer

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