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Traditional architecture to enhance occupants' well-being for a sustainable future in the Middle East

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ABSTRACT: This paper is part of PhD research questioning to what extent modern adaptations to traditional architecture can affect occupants' well-being by modulating temperature and relative humidity. The research aims to assess traditional architecture in the modern context to understand people's physical and psychological needs and preferences. With focus on building performance; temperature as an indicator for thermal comfort. In order to clarify the importance of integration between building environmental practices and cultural perceptual aspects.

With the growth of the population and the urgent need for more dwellings in the Middle East (ME), much of the traditional architectural knowledge that takes the environment into account has been put aside, resulting in an increasing demand for international design concepts.

This research attempts to contribute to the study of environmental design in the service of improved human well-being. This involves questions of how to improve the relationship between people and their environment and the compromises required in this relationship in order to ensure a sustainable future in the Arab region of the ME.

An experiment is in progress to assess temperature and relative humidity in three different types of buildings. Only the initial results collected from the traditional buildings will be discussed in this paper. The researcher will emphasize people's perceptions, behaviors and decisions and their views of cultural existence and change.

1 INTRODUCTION

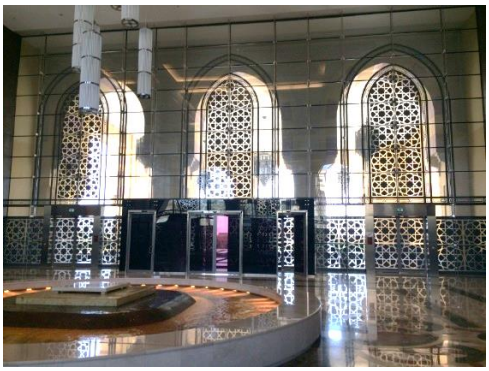
Traditional environmental architecture (TEA) in the Arab region enables occupants to live within a scorching climate. More recently, extensive reliance upon Western building techniques and technology for the sake of modernity and innovation has caused a change in building concepts that affects occupants' well-being. In response, there has been a remarkable movement towards traditional techniques used in a transitional way. This aspect has been excluded from the present paper, but it will be part of the comparison analysis for the PhD research.

By far, one of the most important space indicators relevant to the study of geographical location is the thermal comfort of an immediate and continuous environment. Temperature and relative humidity and the balance between them are essential for climatic comfort and occupants' well-being. Therefore, these measurements have been chosen as the study parameters.

The combination of architecture and culture in its changing environment (including climate change) through its diversity and complexity has an environmental impact. Thermal comfort is the focus of this paper, but different comfort variables will be examined as the research progresses. The aforementioned factors may increase the engagement of cultural technique in an adaptive innovative platform for a sustainable future in the Middle East.

This exploration will consider occupants' physical needs and human emotions; however, the paper will focus on the importance of TEA in maintaining an adequate sustainable environment with the correct expert intervention.

Figure 1. Contemporary musharabia, by author, 2014.



2 RESEARCH EXPLORATION

2.1 *Objectives*

Expectations

- o To recognise the importance of the presence of traditional environmental architecture in the indoor environment and its importance to the thermal comfort of the occupants.
- o To identify the level of knowledge and raise awareness about traditional techniques combined with modern technology in order to address climate change.

Recommendations

- o To underline the impact of innovative technology applied to traditional architectonic features for the occupants' well-being and comfort.
- o To demonstrate the possibility of using traditional and modern adaptations in building standards with consent of local experts.

2.2 *Theoretical Background*

The historical consciousness of the civilizational presence of any city, and the historical depth and extension of that presence, is vitally important in order to enable the city to define its reality and to give expression – architecturally and urbanistically – to its identity and requirements, both present and future (A.L. Abdel Halim, 1984).

(P. Roders and V. Oers, 2012) note that traditional heritage not only represents conventional methods of architectural design for living and building but can also help with future improvements. Acceptance of the traditional means of architecture may be a response to familiar images repeated through centuries. Similarly, certain points of view for approaching modernity reveal an understanding of the existence of the traditional features in the indoor built environment as being a part of the society that cannot be disconnected from the complete framework. As

expressed by (Taib and Rasdi, 2012), by the eighteenth and nineteenth centuries, the effects of globalization on Arabic traditional heritage were detrimental and compromised the traditional cultural traits, leading to an identity crisis. Social practices and cultural traits affect nature and the environment differently within different societies (Johnson, Bowker and Cordell, 2004).

Figure 2. Dubai Old City, CW Guest Columnist, 2014.

Global and economic interchange, along with strong competition between architects, have brought a technological and modern character to Middle Eastern society, resulting in a loss of distinctive place-identity.

Humans' awareness and appreciation of their own identity is necessary for transitional space integration and social meaning valuation, an idea that brings the continuity of traditional architecture to the forefront. (Novakova and Foltinova, 2014) identify the significance of cultural identity in developing a responsive citizenry, and they suggest reconnecting to and interacting with the surroundings within the environment to build intellectual cultural frameworks.

The importance of the link between traditional architectonic features and technology for better indoor environmental quality, a necessity for both physical and visual comfort, can be determined with different variables. The current research focuses on one of the main building parameters, thermal performance, because of its importance in the harsh climate of the ME and its effect on residents' physical and socio-psychological quality of life. Today's technological developments offer various approaches to maximise the amount of usable energy from the sun, and they require skills and disciplinary knowledge to implement them into diverse architectural designs and components (Freewan, 2014).

2.3 *Research Impact*

The research topic is a challenging one within the geographical context of the ME. Although this area of research has been addressed in different academic fields, little research theory exists about the specific research emphasis of the built environment with a focus on indoor spaces as a unit of analysis within the two aspects of culture and climate.

The research focuses on the merging of two different building methods, which allows for design and architectural expertise to be part of meeting societal needs, in addition to the achievement of full integration for the cultural adaption and adoption to modern context in the local built environment. The research will provide valuable additions to the study of the built environment within the ME.

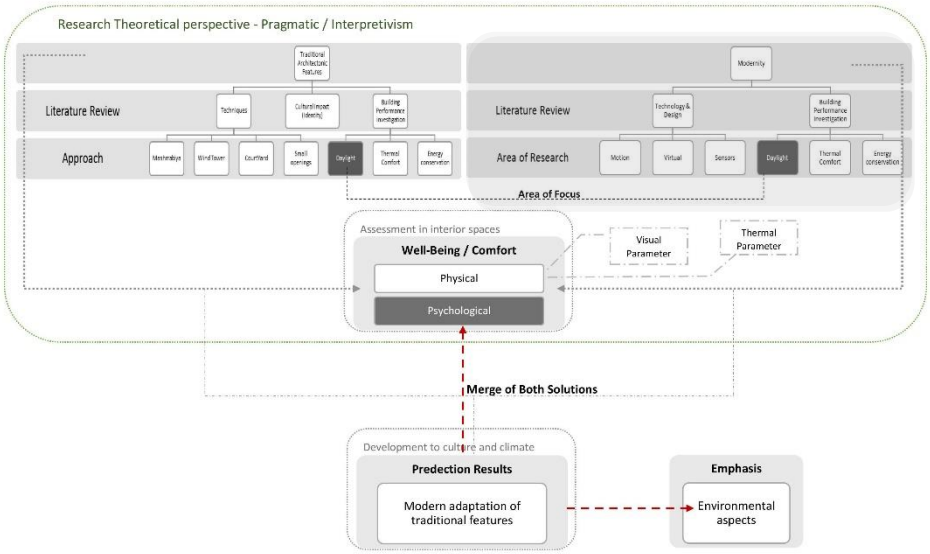


Figure 3. Research conceptual framework.

3 RESEARCH APPROACH

3.1 *Research Method*

The suggested methodological framework will be validated through a case-study experiment examining traditional, transitional and modern housing, with a focus on the interrelation between traditional features and modern techniques and their effects on temperature measurements. The different areas of the research have been identified to complete the PhD study. This paper focuses on traditional buildings.

3.2 *Strategy and research approach*

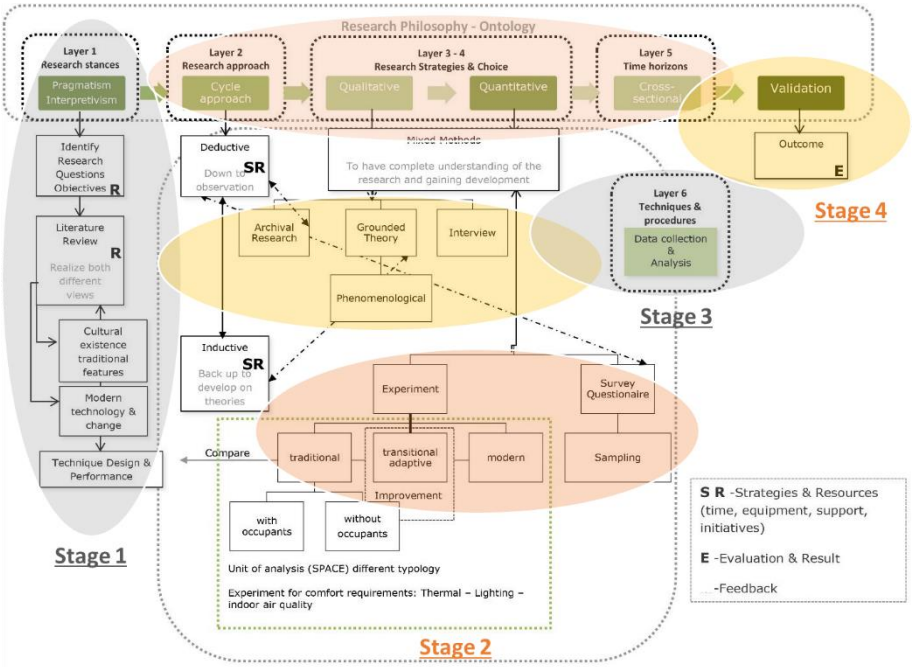


Figure 4. Research methodology process based upon Sanders et al. onion diagram, 2009.

3.3 *Methodology Development*

The proposed methodological process was developed starting with a pilot survey questionnaire. The pilot test was used to acquire a deeper understanding of interests and needs based on people's behaviour in order to increase the reliability for more convincing results. This resulted in an ordered list from most to least favoured responses, and the development requires for the survey assessment. Overall, the data indicate that people are keen to explore new lifestyle patterns with respect to their cultural influences. The initial statement that was most agreed upon was the need for experts to lead the society towards taking suitable decisions for occupants' comfort and well-being.

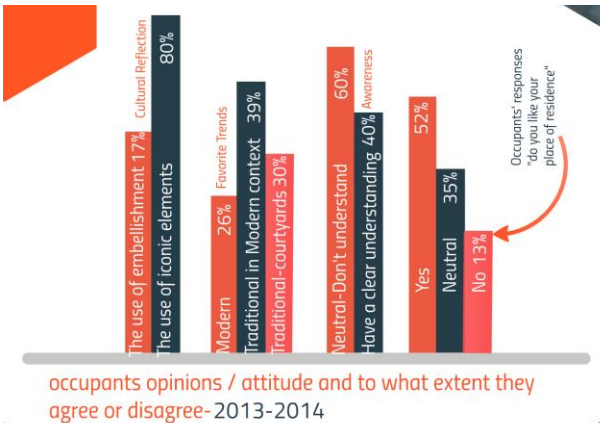


Figure 5. Percentages of occupants' opinions and attitudes regarding traditional and modern building concepts.

People's responses towards housing trends emphasised three main typologies: traditional, transitional and modern. Temperature measurements and thermal comfort of these three building types will be compared at a later stage.

Figure 6. Levels of Most popular housing types.

The second stage of research began with a field visit to historical Diriyah, Riyadh, the original capital of Saudi Arabia. A refurbished site in the Turaif district was chosen it was conducted while no occupants were moved in. This site was selected in 2010 by UNESCO as a World Heritage Site. From the housing blocks in this location, standard block B8-2 was chosen for the case-study experiment. The characteristics of B8-2 include traditional mud houses which have been refurbished with no amendments to their design other than the addition of metal panels (as a fixed exterior shading device to reduce heat gain in the courtyard areas), air conditioning, and artificial lighting.

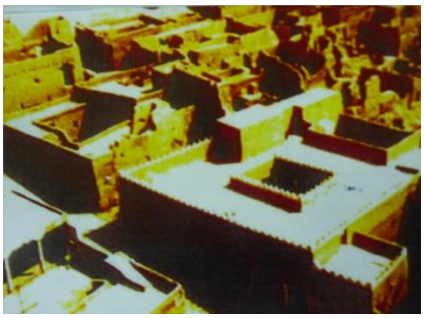


Figure 7. An old photo of historical Ad Diriyah.

Figure 8. Historical Ad Diriyah block B8-2 courtyard, showing data logger (red circle) and metallic panels.

Figure 9. Historical Ad Diriyah block B8-2 indoor/outdoor, showing data logger (red circle).

4 IMPLEMENTATION, ANALYSIS AND FINDINGS

4.1 *Experimental Setup*

Three data loggers were installed in three different zones of block B8-2: courtyard, a living room and an outside wall of the block (outdoor area). The loggers were set to measure temperature and relative humidity.

4.2 *Experiment*

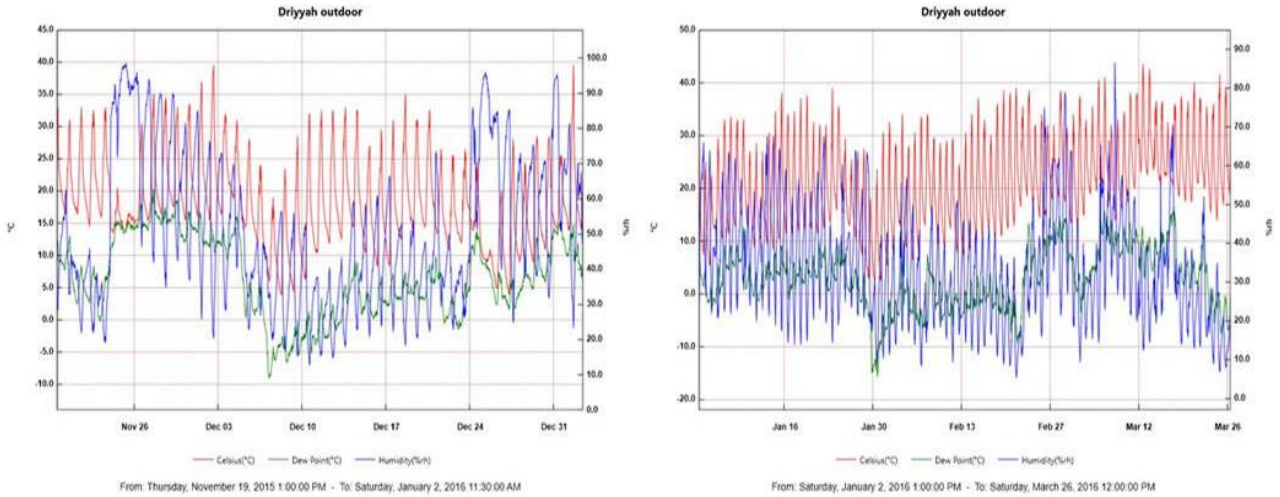
Traditional buildings are built for the purpose of occupants' well-being, which, in the ME, requires cooling the living spaces. Modern techniques can be integrated into traditional buildings when suitable materials are adapted to allow for maintenance of the benefits of TEA. Whereas people are in favour of traditional influences in the built environment.

The data loggers will remain in place for a total of one year. This paper describes data collected over the first four-month period (from the end of November 2015 to the end of March 2016).

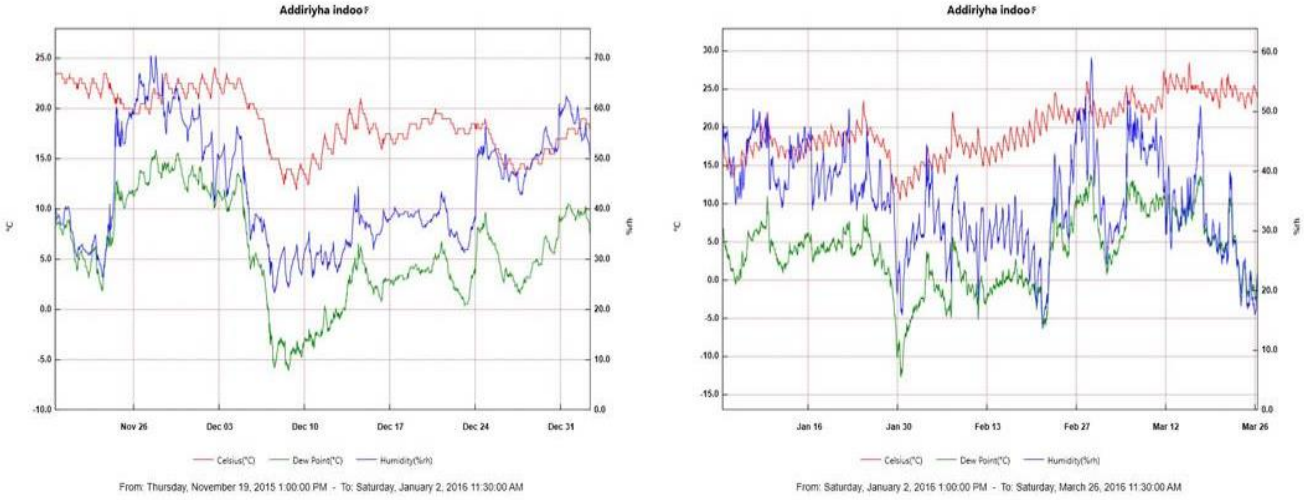
The top row of (Graph 1.) show the temperature, dew point and humidity in the outdoor space. Although the results are extremely fluctuant, they are almost always in concordance with each other except for a few days where humidity was very high and not consistent with the other two parameters, probably due to heavy rain. The outdoor temperature over the four-month period ranged between 4°C and 40°C.

The indoor results (Graph 2.) was slightly more stable in comparison to the outdoor results. The lowest indoor temperature recorded was on 31 January 2016; the lowest outdoor temperature was recorded on the same day. The highest indoor temperature did not exceed 27°C.

Graph 1. Combined results for temperature readings for outdoor area.



Graph 2. Combined results for first and second readings for indoor space.

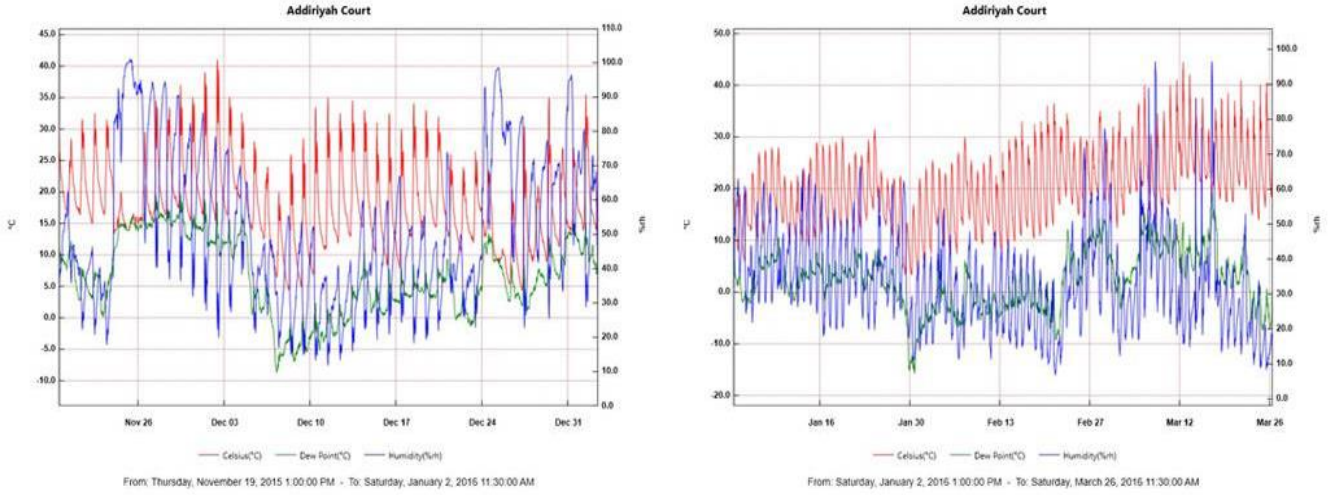


The courtyard is a predominant characteristic of Middle Eastern architecture. The court historically represents the heavenly garden of Islam. It has traditionally been one of the biggest spaces in the building, using wide area with high arches for ventilation. This open space is a gathering point for people. An interior courtyard provides

privacy, but because it is open, it allows light and air to reach the surrounding spaces. The courtyard design, with its cool ventilation, is a very efficient means of climate control.

In the graph below, the results obtained over the first six weeks of the experiment were very similar between those of the outdoor area of the building, whilst the courtyard area with the metal shading was exposed to the sun, causing heat gain. The metal shading was added as an external modern artistic element, but it is inappropriate for the climate because it hampers the function of the courtyard. For that reason, the researcher added paperboard on top of the metallic shading for the remaining period of the experiment, preventing direct contact of the surface with the sun's heat. The restoration of the courtyard's function is obvious in the graph below, which shows that the documented courtyard temperatures were cooler paperboard was installed to prevent the heat of the metallic shading. The higher temperatures at the beginning of March 2016 occurred only because the weather was starting to become warmer.

Graph 3. Combined results for first and second readings for courtyard space.



Informal contact with the people who have access to the building about its recent situation before the installation of the paperboard, indicated they were satisfied with the cool indoor environment, but they were experiencing uncomfortably high temperatures in the courtyard.

5 CONCLUSIONS

This study provides preliminary analysis of a thermal parameter in TEA. The research will contribute to subject-matter knowledge and increase awareness of environmental, physical and psychological factors in relation to cultural values. Further study will be conducted once the building is open to the public since the research reported here was conducted while the building had no occupants. Occupants' level of satisfaction and their response regarding spending time in the location and if the refurbishment has been appropriate in the current situation will be investigated.

The intention in further investigation is to confirm the best building typologies for occupants' well-being and to identify the best combination of traditional techniques and twenty-first-century modern technology.

6 ACKNOWLEDGMENTS

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