

## Interior design elements and its impact on thermal modification

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Indoor Environmental Quality (IEQ) studies undertaken by various scientists showed that the health and productivity of buildings inhabitants is greatly affected by air quality, illumination, and acoustics, and thermal comfort.

The IEQ-and occupant satisfaction variables can be split into physical and non-physical variables. The physical variables generally comprise four components: thermal comfort, indoor air quality, lighting and acoustic environment, which can be assessed by measurable parameters. In general, non-physical variables refer to indoor qualities that are difficult to be measured by instrumentation, such as layout, privacy, furniture, cleanliness, facilities.

### *The Study Problem*

The problem of the research is to study the elements of interior design and their impact **on thermal modification**, and to elicit how to achieve compatibility to be suitable with the environment. The research problem is limited to the following points:

- The designer's lack of interest in the environmental dimension and the importance of preserving energy and natural resources when creating housing designs.
- Not using clean, renewable natural energy. This results in environmental and health risks and problems due to the emission of harmful gases as a result of global warming, buildings become the enemy of the environment instead of being friendly to it.
- Ignoring the role of the designer in how to harmonize between interior design and environmental localization in residential spaces.

### *Questions of the Study*

The Arab world lies between the Tropics of Capricorn and Cancer, it is an area with a hot climate, this climate affects the nature of life, which calls for an attempt to adapt or treat it in the field of architecture and interior architecture, several questions were asked:

- What is the concept of readjustment and sustainability? What are the architectural treatments that achieve comfort rates?
- What is the role of the designer in how to harmonize between interior design and environmental adaptation in the interior spaces?
- What are the climatic factors affecting the interior design to choose the appropriate solutions in line with human comfort?

### *Significance of the Study*

The importance of the research revolves around:

- Determining future trends in the interior design of residential architecture through performance and effectiveness in design.
- Finding design ideas based on a functional basis that is compatible with humane and environmental dimensions.
- Determination of thermal comfort inside the building, through a person's ability to maintain a constant temperature.

- The importance of the designer's role in achieving the concept of sustainability in architecture, through the application of what is known as green building.

### ***Aims of the Study***

The research aims to identify the elements of interior design and their impact on the building, how to achieve compatibility with this environment? Draw conclusions and recommendations regarding this matter:

- The study showing the impact of climate variables and changes in internal architecture.
- The evolution Impact of interior architecture ores used in residential spaces.

### ***Hypotheses of the Study***

Natural, social and spiritual environment are all involved in the formation of housing. Taking into account:

- Creating environmental-based designs while considering our housing needs and requirements and its impact on thermal adaptation, and how to achieve compatibility with this environment.
- Implement internal designs through the observance of environmental design standards.

### ***Methodology of the Study***

In order to achieve the previous goals, the research was based on using the analytical approach to the problem through:

- First: Specification analysis which is characterized by the interior design of sustainable space by following the descriptive analytical method.
- Second: Referring to international examples to consolidate the approach and specifications of environmentally friendly buildings, it is called green architecture.
- Third: Determining the impact of environmental dimension on interior architecture.

### ***Delimitations of the Study***

The effects of the severe warning announced by the United Nations Climate Change Advisers' IPCC of the certain disaster caused by the increase of temperatures up to 10.5 degrees, meaning that water resources have been reduced as a result of evaporation and rising water level in the seas and oceans as a result of the melting of the frozen polar ice at a rate up to 10 feet, which will drown coastal countries, particularly the Delta and Alexandria. The world has begun to prepare and try to protect against the expected damage from rising temperatures and global warming that are worsening in developing countries in hot regions.

### **First, the definition of global warming and its causes:**

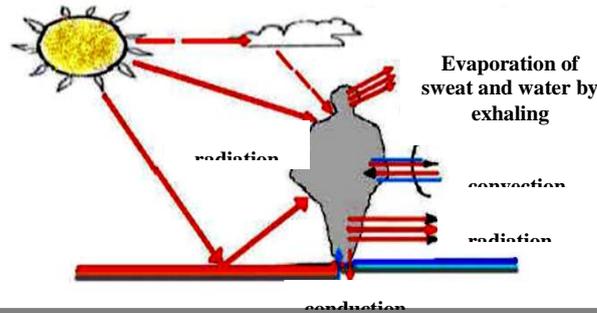
Global warming is defined as the phenomenon of warming in an environment as a result of a change in thermal energy fluidity to and from the environment. This is due to global warming, where climate temperature has increased over the last century, half a degree Celsius, the ice in the poles and above the peaks of the Australian mountains has been melting significantly, and this is emitting methane, which is one of the most temperature-raising gases.

For decades and centuries, advanced industrialized countries are responsible for the global warming that causes an increase in carbon dioxide in the atmosphere. The United States rejected the Kyoto Environmental Protection Treaty, although it was responsible for 30% of the problem, followed by Europe with 27.7%, Australia with 13.7%, Japan with 3.7%, Latin

America with 3.8%, the Middle East with 2.6%, Africa with about the same proportion, Canada with 2.3%.

**Second, causes of the emergence of environmentally friendly buildings**

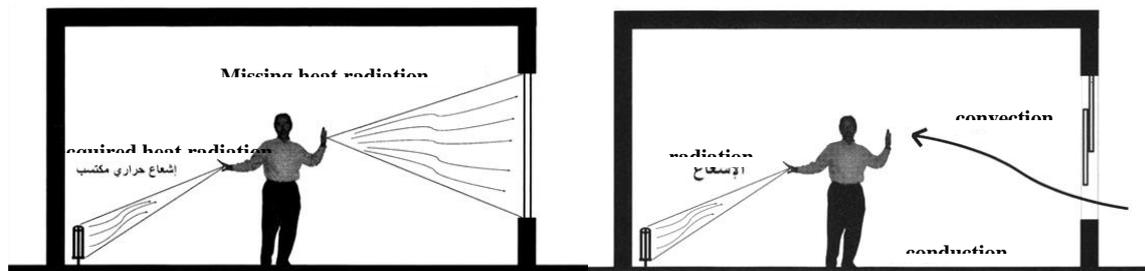
The human body can maintain internal heat through a process called thermostat, which helps to avoid health problems that may affect the human body. Human body temperature is known to be constant, ranging from 36.5 to 37.5 degrees Celsius, and 60% of manufactured energy is converted from cell production to thermal energy that keeps the body's heat stable.



Sketch illustrates the heat exchange between the human body and the surrounding environment.

The interior architect can control energy and thermal balance significantly by studying the specifications of materials and ores for enthalpy and clefting, knowing how much they store energy and how much they can retrieve it (radiation) again, such as using bricks, adobe bricks and concrete blocks as a size for building and as a material for chisel walls. Treated timber is also used in radioactive thermal mass floors for the following reasons:

- The age of Finishing Materials and its potential for reuse.
- The extent to which Finishing Materials contribute to the enrichment of the model and reduce its negative impact on the interior.
- Wavelength materials fit into the elasticity of the design and it is used as an internal thermodynamic balance element.



Sketch explains how human heat is transmitted by radiation from hot surfaces and released from our bodies to cold surfaces in winter.

Sketch explains the mechanism for heat transfer: Three basic means of heat transfer are conduction, convection, and radiation. Delivery requires direct physical contact, and convection needs a flattening movement like air or water, radiation occurs between surfaces.

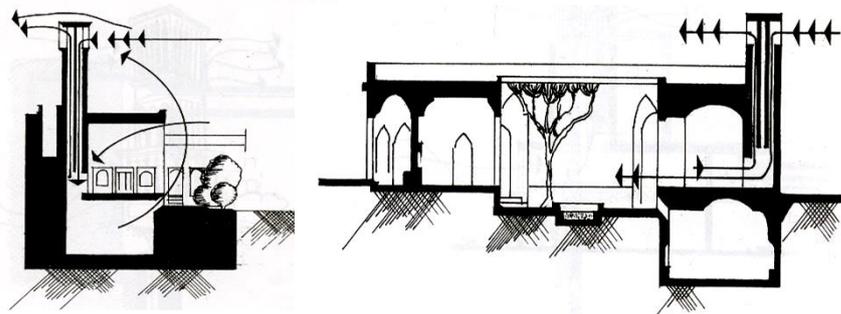
**Third: interior design between environmental reality and modern technology:**

By developing the shape of residential buildings through the emerging energy system, in order to try to achieve interior spaces with a design system balanced with the environment, and

through a good understanding of contemporary design determinants, technological studies have tended to focus on the study of methods that support environmental minimization by learning about the most important environmental challenges of hot regions , and to review the major impacts that have affected the shape and design of residential interior spaces, and their elements of stereoscopic trajectory and parameters and its determinants from the perspective of the warming of environmental realities, which have come to receive the attention of many specialists. The most notable damage was:

- Relative humidity that creates discomfort and leads to sepsis in walls and ceilings with spaces
- Extreme heat in residential spaces, cooling and air conditioning methods that are harmful to the external environment and consuming high energy rates, as well as the emergence of thermal retention.
- lack of water and how to obtain alternative sources.
- Dust, and pests spread over hot regions.
- With those damages identified and analyzed, to try to find the most appropriate solutions to:
- Provision of a healthy environment suitable for residential spaces.
- Setting the temperature rest limits of the climate within the residential interior.
- Implementing a contemporary, formatively proportional interior design that follows the modern technological system of environmental adaptation.
- Identification of NAHO materials and equipment that can be used in the design and implementation of residential buildings for the best health for users.

Sustainable design compatible with the environment is not a new idea; it has existed since time immemorial. The principles of sustainable design are integrated with those of the design thinking of ancient traditional Islamic Arab architecture, whose solutions have proved successful over long periods, and the error of using local building materials, with simple, thoughtful techniques, but stemming from its local environment, to rationalize energy consumption and provide the thermal comfort of the user, which can be developed for the modern building. (Location and Design, Shading and Afforestation, Natural Ventilation, Building Materials, Naho and Shredding Materials, Environmental Design and Energy Conservation).



Use of natural ventilation and the internal yard of a traditional residence in Saudi Arabia

#### Fourth: Readjustment - Climate Treatments

Readjustment is the alignment of our intellectual approaches and our design model with the new conditions and challenges that emerge through change and rethink with a new intellectual perspective. The idea of sustainability was based on the principle of respect for the environment

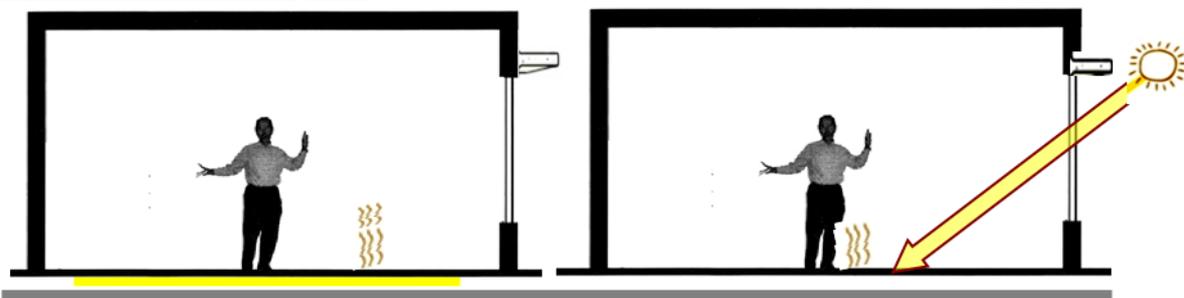
and the needs of future generations through design solutions, and not to go beyond the red lines that would damage the environment. These are the foundations that we need as a starting point for achieving a positive future for the application of the principle of sustainability with the same intellectual orientation and design model that have caused the problems that sustainability seeks to overcome. This would result in a change in form rather than in substance; In the long term, if this formatted design model continues to be used as a basis for the development of sustainability, the result will be a false sustainability.

In accordance with its principles, sustainability provides many environmental treatments for a residential building to be a place of comfort for its residents in the present and in the future through some of the guiding criteria that the designer can follow, both in architecture and interior design. Future directions treat housing as a unit of an integrated population that achieves the concept of a sustainable society. There are four types of adaptation:

- 1) **Anticipatory (proactive) adaptation :**
- 2) **Planned adaptation**
- 3) **Reactive adaptation**
- 4) **Autonomous (spontaneous) adaptation**

### **Climate and thermal mass**

Thermal mass absorbs heat during the day, so as to prevent the effects of rising temperatures and then store heat until it falls inside the indoor space during the night. Heat is then naturally emitted from thermal mass matter to internal spaces. Thermal mass is an effective design element in improving the building's level of thermal comfort during classes of the year. Heat mass plays an important role in heating, ventilation and air conditioning, naturally inside the inner space and without the need for mechanical systems, heat mass flows heat energy from the inside out and through the inner space, and one of the insulation patterns within the inner space, thereby reducing the penetration and flow of heat, thereby helping to achieve thermal comfort with different internal spaces.



*Sketch explains the heat mass function by reheating the heat stored at the lower temperature rate within the geometries to provide heat balance.*

*Sketch explains how the heat mass absorbs the Sun's direct heat and stores it inside it.*

### **Thermal mass inside buildings**

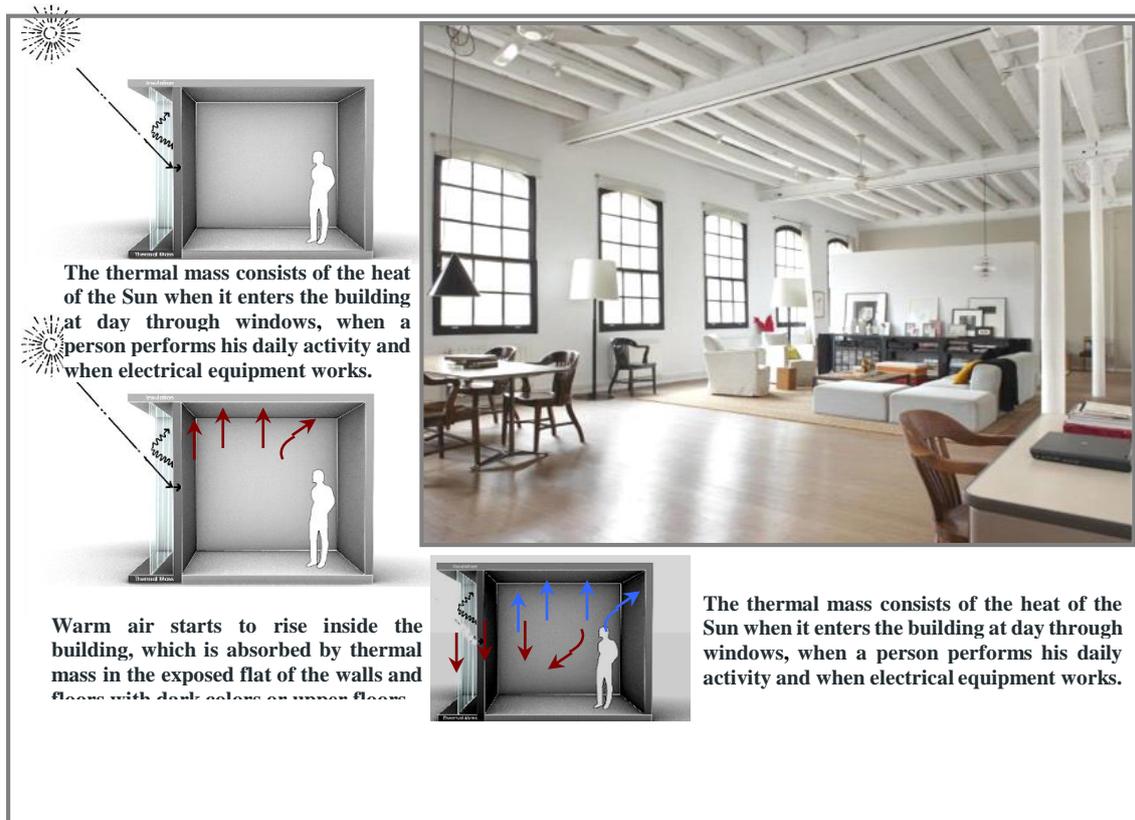
Thermal mass is effective in improving the comfort level of a building anywhere (facing daily fluctuations of temperature), both in winter and also in summer. When its well used and together

with passive solar radiation, thermal mass can play an important role in significantly reducing energy use in heating, ventilation and air conditioning

**Thermal balance:**

Thermal balance is an important thing for a residential building, as it is important for the human body. In order to achieve heat balance in a building, the amount of heat gained (conduction, deformation, or acquisition of sunlight, or internal heat) must be equal to the heat lost. Thermal acquisition occurs through several sources: Internal heat, such as people, electrical appliances, ventilation and air leaks, and the building's casing by plugging through the painted surfaces, and through window glass through conduction and solar radiation through window glass.

The study of thermal mass floor processors in sustainable interior architecture and solar self-features is very different from traditional dwelling floor processors. The treatments and ores used in the Nahu and shattering process play an important role. Thermal mass represents one of the heat storage patterns within the interior. One of the difficulties facing the designer is to study the ability of each ore to store heat when designing floors because there are few available ores with the capacity to store heat, which has been taken into account using many operational techniques for conventional ores with high storage capacity. Cement, red bricks and stones are the best materials used in thermal mass floors, and it is preferable to use rough-textured ores to increase their heat storage capacity.



**Building design that discusses how to add new blocks to buildings that resist temperature fluctuations, sometimes known as thermally balanced fly weed effect, for example, when there's an oscillation of temperature outside, these blocks can absorb heat and then breathe this energy into the lower temperature zone.**

**A screenshot showing an inner space that does not prefer to cover the floors of the heat mass exposed directly to the sun's rays with carpets, so that it does not represent a buffer that prevents the floors from absorbing heat.**

### **Trombe Walls :**

The Trombe Wall is a glass in a distance 10 to 20 cm from the wall, and the space between them serves to store heat. It is usually painted in a dark color to favor the movement of hot air that tends to raise, and it enters the house from the openings at the top in order to allow the cold air from the interior to enter the wall cover of thermal mass materials such as Adobe bricks or cast cement powder concrete. When using trumpet walls to collect and store heat, there should be nothing to block sunlight from the wall, so it is preferable to use only one or two open furniture units so that heat is not blocked, taken into account:

- Trombe walls are painted in dark paint like (green, purple, brown, and black)
- It is preferable to spray paint on it instead of using rolls or brushes to get maximum heat absorption.
- No accessories units or paintings on those walls should be used because the heat released damage them.
- When using half-Trombe walls, windows must be isolated at night to prevent them from losing the heat gained during the day.

### **Direct Evaporation:**

This method is based on the passage of dry air through an ephemeral canine humid medium filled with water or a quantity of charcoal placed on a metal grid. This increases the humidity of the air and drops its temperature. Wind catcher is one of the classic smart solutions to this system.

### **Conclusions:**

Environmentally friendly buildings are concerned with preserving primary resources that include (energy efficiency), (renewable energy) and (water retention), reducing environmental impact, reducing waste, creating a healthy and comfortable environment, reducing operating and running costs, and with social infrastructure systems. The life-cycle of the building is considered in terms of cost, performance and environmental impact.

### **Results**

- There is a direct link between sustainability and the environment through economic development.
- Conservation of environmental resources from pollution and depletion in order to achieve a healthy and sustainable environment.
- The ecological impact on humans must be studied, basic needs met and possible problems devised
- The design is an interaction between the environment and the building to reach sustainability, and the strengths at the site that can connect the building and the surrounding environment must be found.
- Sustainable design aims at reducing consumption of non-renewable resources and searching for natural resources (such as solar and wind energy) as well as reducing the use of toxic and non-recyclable substances and re-usage.

- Recent advances in technology and the portability of advanced energy sources and building materials have helped to find different remote solutions, but many of these solutions are draining the planet despite modern technologies.
- Sustainable development is the result of the efforts of society as a whole across long-term holistic lines towards achieving and developing a balanced society with well-thought-out environmental, economic, social and political policies studies.

**Recommendations:**

- Development of professional regulations and controls that encourage designer engineering offices to adopt green architecture and sustainable building practices and applications during design and supervision.
- Establishment of a professional support for designers called the Green Architecture and Sustainable Buildings Unit, which will serve as a meeting place for architects, engineers, designers and those interested in this field and provide them with technical and information support.
- Integrating the practices and applications of sustainable architecture and green buildings with value engineering.
- High-capacity building materials must be used to overcome the large thermal characteristic. Thermal resistance to building materials used with soft surfaces.  
Use of light colors and reflective surfaces:
  - Use of dome, basement and curved surface.
  - Lower openings with external facades.
  - Using the upper apertures below the extended ceiling serves to move the hot air layer.
  - The designer should know about environmental issues while doing design and opening up to everything that's new.
  - Academic institutions must foster environmental awareness, introduce research and train them in the ethics of sustainable environmental design, and develop their skills and cognitive foundations in continuous design.