

Environmentally sustainable interior design technology in light of the spread of global epidemics

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Abstract :

The world has evolved a lot recently, as the world has witnessed six epidemics from the twenty-first century until now, the first of which was severe acute respiratory syndrome, Middle East respiratory syndrome, Ebola, bird flu, swine flu, and finally the emerging corona epidemic. If we had already entered the era of epidemics, it was necessary to conduct many studies, that we will deal with in our study, as it was found that interior designers must start applying new standards for designing the internal and external vacuum, including for example, taking into account advanced basics to study interior and exterior design elements (floors, walls,, lighting, ventilation) and determine the number of people who live in one internal space. As architecture is a mirror that reflects the culture of society, as it expresses the identity of the designer, his personality and the extent to which he keeps pace with emergent and changing events, therefore, architectural and design creativity is characterized in most of its designs by seeking to design external and internal vacuum that remain safe and livable and whose vacuum are not devoid of their occupants once an epidemic breaks out. The occupants of a single interior space are not concerned about being with each other.

To activate this, the most important precautionary measures that must be taken into account when epidemics spread will be identified, the basic design principles necessary to limit the rapid spread of epidemics in the internal void will be identified, on the one hand, a new vision of the contemporary interior space design elements (shape, void, function), and on the other hand, presenting a new vision for developing traditional methods that are already present in the internal vacuum with advanced technology, to reach environmentally sustainable internal spaces capable of withstanding in the face of pandemics and epidemics.

Keywords :

Epidemics, interior design, technology

Introduction ...

Many statistics indicate that ٦٨ percent of the world's population will live in cities by ٢٠٥٠, so it was necessary in the coming days to redesign the internal and external spaces of buildings for various activities to be able to withstand the epidemics that spread successively in the twenty-first century.

Many designers have warned about the importance of changing buildings from inside and outside, especially after they realized that epidemics will become part of our lives, and thinking began to take urgent measures to confront such crises, such as establishing health centers and isolated temporary internal spaces easily, and allocating spaces for this purpose, such as

increasing the number of elevators in tall buildings, and building an additional staircase for residents to avoid contact and approach with others while climbing or descending the stairs.

To achieve this, it is necessary to cooperate between microbiologists with engineers, designers of buildings and managers of the activities of those buildings, to reach strategic plans to reduce the chances of reproduction and transmission of pathogens among people.

Researchers from the Genomic Center at the University of California, School of Medicine, and the Center for Biology and Built Environment, University of Oregon in the United States, conducted a major research to find pathways and exchange mechanisms for common pathogens in diverse built environments. The research addressed the following:

- The degree of spread of microbes and their quantities
- Diversity of epidemics
- The method of transmission of epidemics in various environments (intended for every human-made environment, whether it is a home, school, university, market, transport vehicles, prisons, company offices, government buildings, etc).

On April, ٢٠٢٠, with the emergence of the Covid^{١٩} pandemic, the increase in the number of infected people, the rapid spread of infection among people, and the importance of preparing for life after this pandemic, researchers wrote a review that collected their previous studies and those of others on the microbiology of built environment research and known information about SARS-CoV- ٢ to provide practical and achievable guidance for decision-makers, building operators and designers, and all indoor residents who are trying to reduce the transmission of infectious diseases through the pathways mediated by the environment.

In view of these post-modern studies and during the spread of the epidemic, the design and implementation thought changed in architecture and the interior design of spaces, and attention was paid to using broader and deeper techniques than postmodern changes (which are concerned with appearances), and this is what we will discuss in detail in this study .

Research problem

The research problem is to answer these questions:

- Are there internal spaces that provide effective social isolation according to the desired activities of their residents?
- Is it possible to make some formative and functional adjustments to the current internal vacuums to cope with the requirements of the precautionary measures necessary to address the various successive epidemics?

Research goals:

- Explain the effect of the current situation (the spread of successive epidemics) on the future of interior design and architecture to reach internal spaces that achieve protection from contact and exposure to viruses.
- Emphasizing the importance of reconsidering and thinking for every designer and architect in new, sophisticated and appropriate methodologies for selecting and distributing interior design elements (floors, walls,, furniture) within various environments.
- Emphasize the importance of how every designer and architect be up to date with new developed methodologies that are suitable for the selection and distribution of interior design (elements of flooring, walls,, Furniture) within diverse environments.

Research hypotheses and questions

This study belongs to the theories of thought that assume that:

- Environmental sustainable architecture works to provide technological solutions to design an appropriate internal space for the precautionary measures required to confront epidemics.
- Environmental sustainable architecture opens advanced technical horizons to integrate the internal space with the surrounding environment.
- Applying the principles of sustainable environmental architecture to prepare for the spread of any epidemic that enriches the internal vacuum, formally and functionally.

Research Methodology

To achieve the research hypotheses, the following approaches are followed:

First, descriptive analytical method: through an analytical study of the concepts and ideas of sustainable environmental architecture, historically and recently, and its reflection on interior design.

Second, study the impact and precautionary measures required at the time of the spread of epidemics.

Third, the experimental method: through the applied study, which aims to monitor and analyze projects and applied products in the field of interior design.

Historical background

Since the beginning of the twentieth century, there has been a great development in both environmental sustainability and the spread of epidemics on a global scale, and in the next lines we will deal with a brief overview of each of them to determine the precautionary measures required to be available so that we can define the technologies provided by environmental sustainability to confront and how to coexist during the spread of epidemics and hereafter .

A brief history of environmental sustainability:

Environmental sustainability has evolved through the ages and its patterns have varied and each style distinguishes it from the other like the following::

- 1) **Green design:** increase the efficiency of resources used in buildings such as energy and water and reduce the negative effects on human health and the environment. (as in Figure (1)

What Is Green Building?

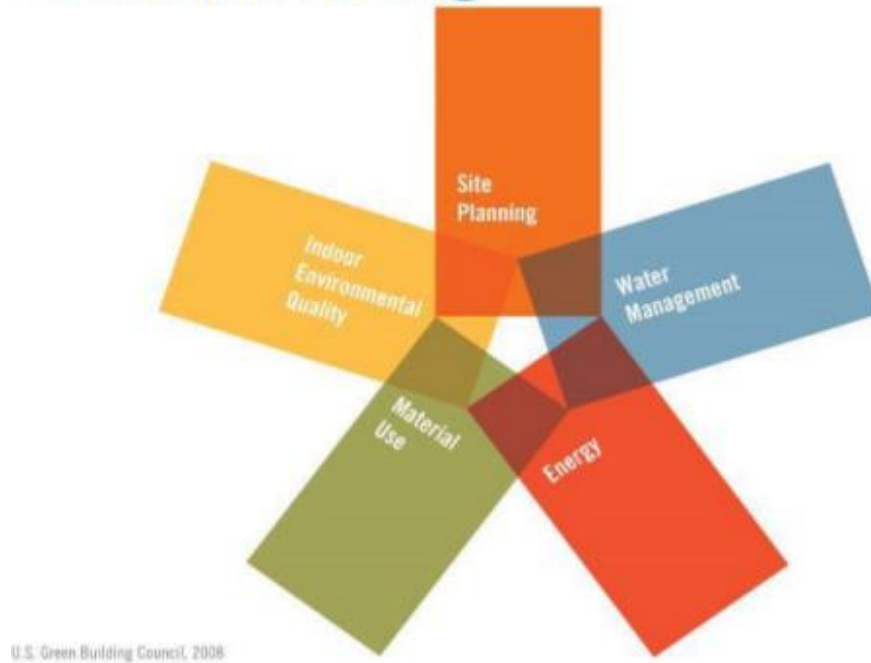


Figure (1) illustrates the meaning of green building(water mangement,energy,material use,indoor environment quality,site planning)

[Green Buildings 101 | Building Efficiency Initiative | WRI Ross Center for Sustainable Cities](#)

1) **Sustainable design** :In addition to the optimal use of resources from energy to water to materials, it is concerned with a comprehensive concept in all aspects of environmental, economic and social aspects. (as in Figures (2,3)



Figure (2) [التنمية المستدامة \(maan-ctr.org\)](#)

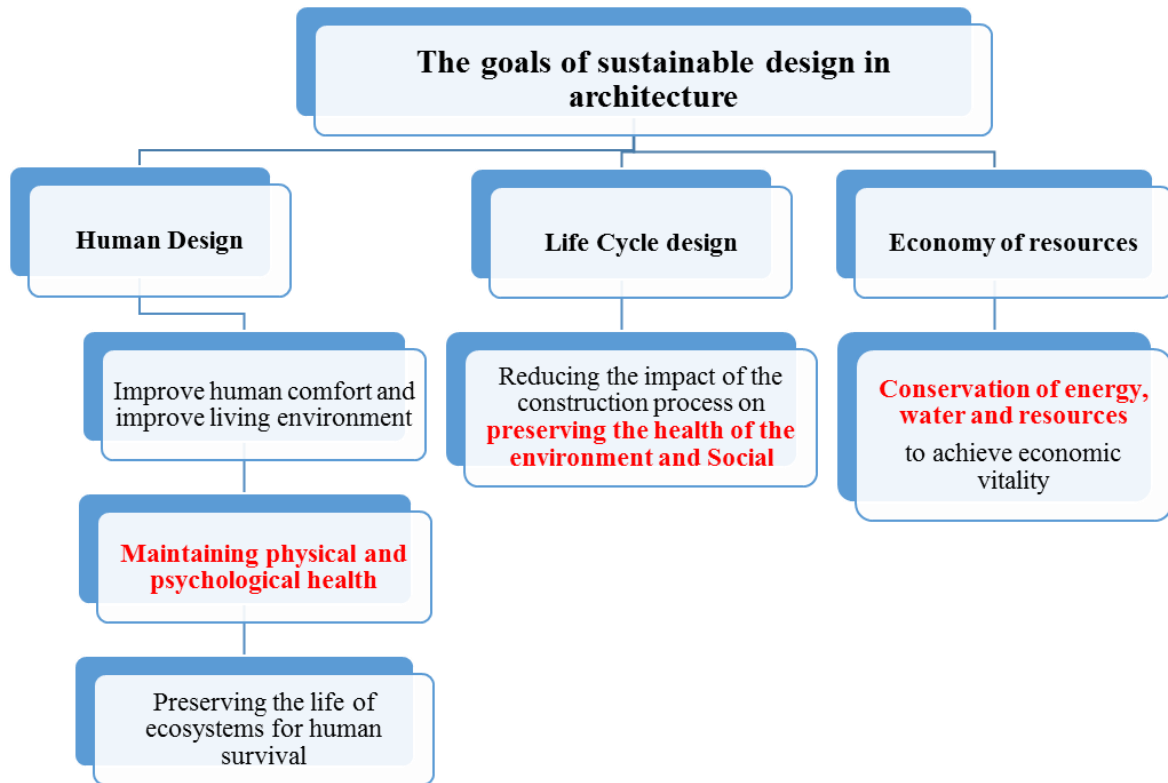


Figure (3) illustrates the goals of sustainable design in architecture(the researcher's work)

2) Restoration design : Additional terms can be used to describe the restorative environment, such as the environment of healing, treatment, integration and revitalization, as restorative environmental design seeks to repair the relationship between the environment and people.

2) Environmental regenerative design: relates to thinking about the future, where designers must design with the future in mind every step of the way. Unlike sustainably designed buildings, which are based on the concept of using only the minimum resources you need, regenerative buildings are designed and operated to reverse damage and have a positive net impact on the environment. (as in Figure (4))

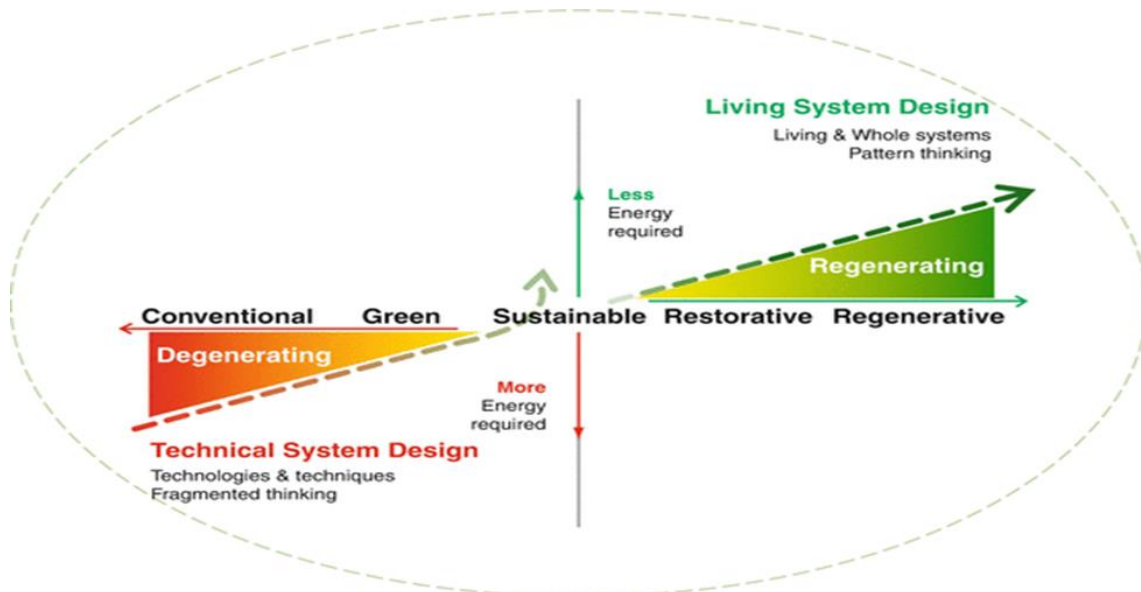


Figure (4) illustrates the Environmental Design Path
[Regenerative Development and Design | SpringerLink](#)

The historical development of epidemics:

Epidemics over the last ١٥٠ years have become viral, killing tens of millions, as the twenty-first century has so far witnessed six epidemics, the first of which was severe acute respiratory syndrome (SARS), Middle East Respiratory Syndrome (MERS), Ebola, avian influenza H^٥N^١, swine flu H^١N^١, and finally the new Corona epidemic, which we will discuss in the next lines in detail ...

The new Corona epidemic:

Coronavirus (COVID-١٩) is a disease caused by a virus that can spread from person to person. The virus that causes COVID-١٩ is a new corona virus that has spread throughout the world. Symptoms of COVID-١٩ can range from mild (or no symptoms) to severe illness. Recently, by the end of ٢٠١٩, the Chinese government reported to the WHO many cases of pneumonia with uncommon causes. The outbreak started from a seafood market in Hunan, in the Chinese city of Wuhan.

- On January ١٢, ٢٠٢٠, the Chinese National Health Commission issued more details about the epidemic, the virus was identified as a new corona virus .. These observations indicated the human ability to spread this virus, the virus spreads from human to human due to close contact with an infected person or exposure to coughing, sneezing, respiratory droplets, or aerosols.

It is possible to visualize the strategic objectives of the World Health Organization, namely:

١. Stopping human-to-human transmission including limiting secondary infection between close contacts and healthcare workers, preventing transmission amplification events, and preventing further international spread.
٢. Early identification, isolation and care of patients, including optimal care of infected patients.
٣. Identify and reduce transmission from the animal source.

٤. Addressing critical unknowns regarding clinical severity, extent of transmission and infection, treatment options, and accelerating development of diagnoses, treatments and vaccines.

٥. Communicate important information about events and risks to all societies and combat misinformation.

٦. Reducing social and economic impact through multi-sector partnerships.

٧. This can be achieved through a set of public health measures, such as rapid identification, diagnosis and treatment of cases, identification and follow-up of contacts, infection prevention and control in health care settings, implementation of health measures for travelers, awareness - raising the level of the population and reporting risks.

How COVID-١٩ Spreads:

- The infection can be contracted by close contact (about ٦ feet or two arms) with a person who has COVID-١٩. COVID-١٩ spreads mainly from person to person.

- You can become infected from respiratory droplets when an infected person coughs, sneezes or talks.

You may also be able to get it by touching a surface or object with the virus on it, and then touching the mouth, nose, or eyes.

Joint precautionary measures to limit the spread of epidemics and their relationship to the design of the internal vacuum:

١. Avoid exposure to the virus that causes COVID-١٩, (Provide adequate ventilation, ...).

٢. Stay at home as much as possible and avoid close contact with others. (Provide multifunctional spaces, ..).

٣. Wear a mask that covers the nose and mouth in public places, and avoid touching the eyes, mouth and nose with unwashed hands.

٤. Clean and disinfect frequently touched surfaces.

٥. Wash hands often with soap and water for at least ٢٠ seconds, or use an alcohol-based hand sanitizer that contains at least %٦٠ alcohol.

٦. Hospitals, schools and borders were closed.

٧. Make sterilization gates for people at the main doors of places of malls, administrative places, universities and schools.

٨. Measuring the temperature of people passing through the main gates of public places and educational places after the end of the complete closure.

٩. Many governments advised their citizens not to travel to the most affected areas.

١٠. Epidemics at their start did not have a vaccine, which forced the health authorities to resort to the control tools that go back to the first days: isolation and quarantine. (Provide multifunctional spaces, ..)

١١. The World Health Organization recommended conducting an examination at airports for passengers departing from areas that have been transported locally, and issued advice to airlines on the steps to take in the event of discovering a suspected case during the flight.

١٢. Organizing the safe and dignified burial of people who have died, and not participating in the usual rituals, whether funeral rites or burial rites.

١٣. Taking into account health care workers who treat infected patients and applying additional measures and taking health precautions to combat infection to prevent contact with the patient's

blood, body fluids, surfaces or contaminated materials such as clothes and bedding by using protective clothing. (Providing multifunctional quarantine spaces, ..)

The following figure (4) illustrates the principles of sustainability to help implement the precautionary measures mentioned to avoid the spread of epidemics mentioned above.

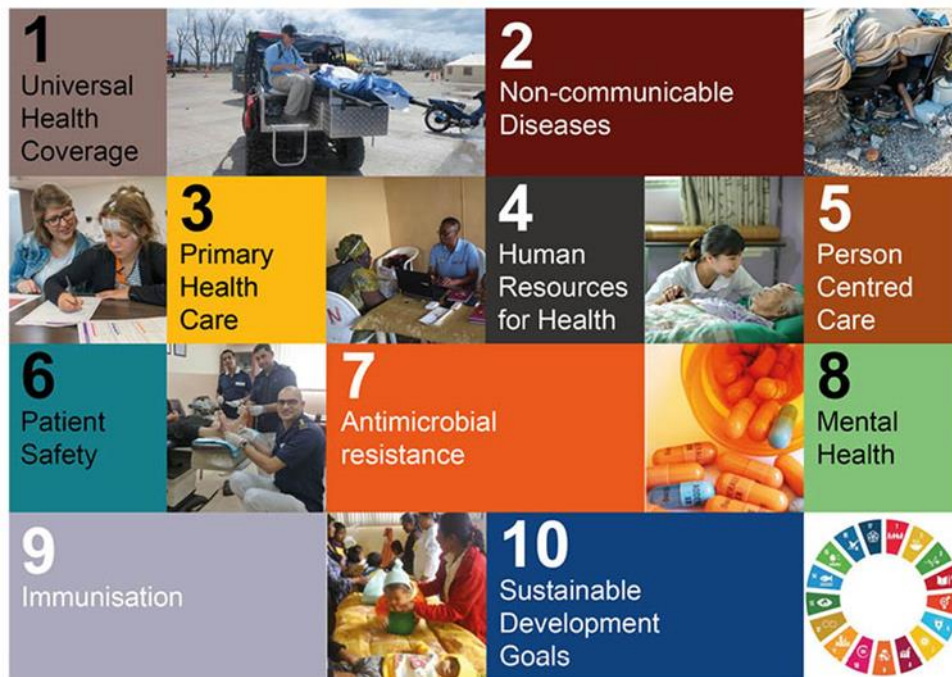


Figure (4) illustrates Sustainable Development Goals to avoid the spread of epidemics

<https://ar.unesco.org/sdgs>

In order to avoid the spread of infection and to implement previous precautionary measures, many techniques have been changed in various works such as:

- 1) **Press:** - The design of newspaper offices has been changed from separate rooms to large open spaces .
-Organizing virtual activities) on the line (variety (meetings, meetings, awareness.
- 2) **Education:** - The method of study and examinations has been changed in different stages whether before university or higher or graduate to become online or hybrid (online part and face-to-face.
-The interior design of the classrooms has been changed (furniture distribution, ventilation) .
- 3) **Various disciplines:** - The mechanism of the management of work in various disciplines has been changed whether by changing the number of vacuum occupants or changing the nature of the work to become part of it online.
- 4) Countries have been imposed on the need to seek to achieve agreements and projects to defend the climate and environment and fight pollution.
- 5) Attention to the application of smart building technologies that contain air conditioners that eliminate germs and viruses.

From the foregoing study of the previous precautionary measures to limit the spread of epidemics, it becomes clear the importance of studying the possibility of developing the design of the internal space for any establishment (residential, commercial, administrative, tourism, ...), whether the vacuum is already existing or will be established.

Joint precautionary measures to confront various epidemics:

According to the information available so far, the only documented way of transmitting infection for most epidemics (including the recently spreading global outbreak CoV-٢) is:

- **Directly from person to person.**
- **Across surfaces:** Viruses also settle on surfaces, which can become heavily contaminated very quickly (the survival time of SARS-CoV-٢ on surfaces is still up for debate and estimates range from two hours to a few days, depending on materials and conditions).

Therefore it is important to clean surfaces regularly and wash hands thoroughly.

Environmental sustainability techniques to reduce direct contact with community services in times of epidemics:

Sustainable design is more important to the health and wellness of our societies today. Our internal vacuums in private or public facilities were not ready when epidemics spread, on the contrary, responsive to emergency accidents and mass losses such as terrorist attacks or chemical / biological events or natural disasters such as earthquakes, hurricanes and fires.

As the design is the plan and the determinants that you set before starting the thing in order to know how its shape is and how it can be used correctly to solve a specific problem, so it has a great role in all precautionary measures to confront the Corona virus, and the technique of using design can classify the design into two types. The two main ones are:

- 1) **Sensory design:** such as designing buildings, devices, and cars.
- 2) **Non-sensory design:** such as experiences, services, and behavior.

What is meant by designing services is to design any service provided to the customer to be inclusive of the customer's experience in full, before using the service, during it, and after its completion.

In light of the transmission of %٨٠ of infectious diseases through touching contaminated surfaces, new technologies have been considered to reduce direct contact with all surfaces, as sustainable environmental design techniques can be divided into the following:

- Technology using advanced (smart) technology: to control all interior design elements (curtains - lighting - ventilation -) .
- A technique for developing new environmental sustainability designs to deal with the existing situation.



Figure (5) illustrates using of sustainability principles to design natural ventilation strategies, operable shade windows and night vents - control of water flow - drainage. Oxnard Union County Rancho Campana High School (Designed by HMC Architects)

<https://hmcarchitects.com>

The impact of environmental sustainability on the internal vacuum in times of epidemics:

The concept of environmental sustainability: “It is the optimal utilization of available environmental resources and capabilities, whether they are human, material or natural, in an effective, environmentally and urban balance to ensure continuity of use without wasting the gains of future generations.” From this definition we can say that environmentally sustainable design is design in an environmentally friendly manner, formally and functionally. It is suitable for the lifestyle with its different developments, so it develops to keep pace with and conform to the precautionary measures that must be observed in the time of the spread of epidemics.

Four main objectives for environmentally sustainable design have been identified under the Organization for Economic Cooperation and Development (OECD)², which are as follows:

- 1) **Efficiency of sources**
- 2) **Energy efficiency**
- 3) **Compatibility with the environment**
- 4) **Complementarity and organization of curricula**, including the organization of environmental management through a set of concepts, all evoking environmental, economic and social challenges to create new design methods that contribute to achieving the precautionary measures to be followed at the time of the spread of epidemics. Among these methods are the following: (Sustainable design. - Architecture. Green - sustainable constructions - green building - environmental regeneration design.)

There is no doubt that achieving the idea of integration and compatibility between the internal environment - whether from the indirect formative side or the direct formative - and between architecture on the one hand and the environment on the other hand has a great impact on the design of the internal space, especially amid the precautionary measures to confront any epidemic, and it differs. Hence, new concepts have been added and recognized, while some traditional concepts have disappeared, and new vocabulary has emerged from the necessity to be present in the internal space to achieve that integration (the internal environment - architecture - the environmental environment).

Therefore, it is important to study the impact and precautionary measures required at the time of the spread of epidemics (Corona virus ١٩ for example) on the internal space and its various elements, and we will address in the next lines its impact and applications through stages illustrated by the following figure (6):

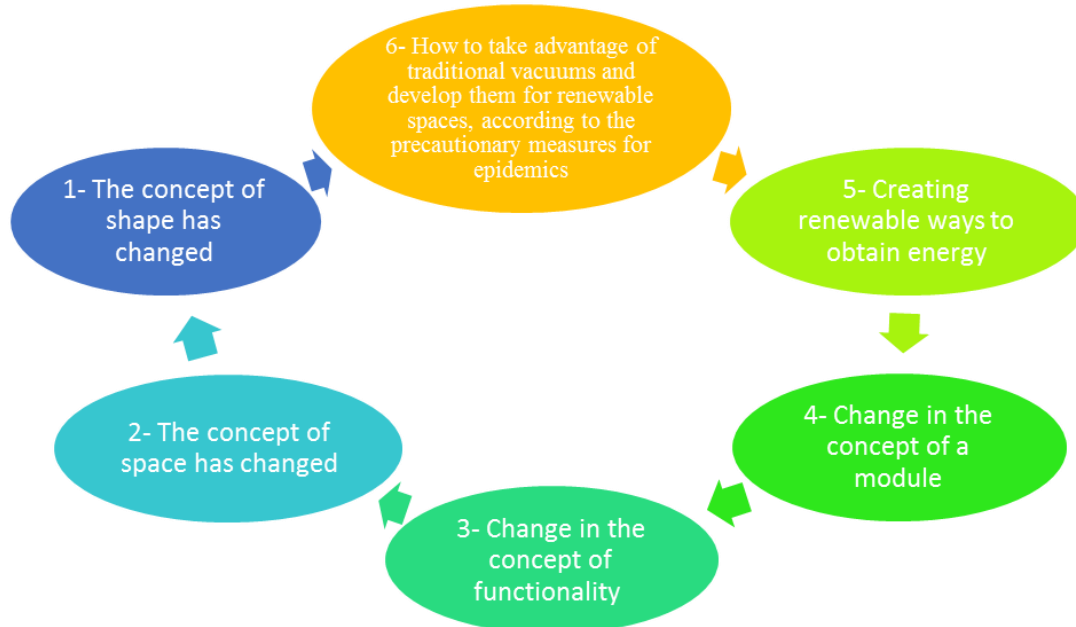


Figure (6) illustrates the techniques of interior design concepts that have changed to cope with the spread of epidemics(the researcher's work)

- First, the concept of shape has changed:

There is no doubt that the development in the concept of form has greatly affected the style of vacuum treatment and the method of dividing the activities that take place within it.

Design applications on changing the concept of shape in design;

1. New door handles open:

New shape design for a hygienic clip design that is small enough to fit in a pocket to handle handles of all kinds .The clip is made of a solid, non-porous material, which makes it easy to clean.



Figure (7) shows the shape of the sanitary clamp used to handle the doorknobs
skynewsarabia.com

2. New look for multi-purpose filing cabinet in public places

The choice of a form for the disinfection of nurses' clothes technology has been applied at the Universidad Privada del Norte in Peru, where a smart wardrobe was designed, "where the work uniform is placed and cleaned by chemicals and UV rays."

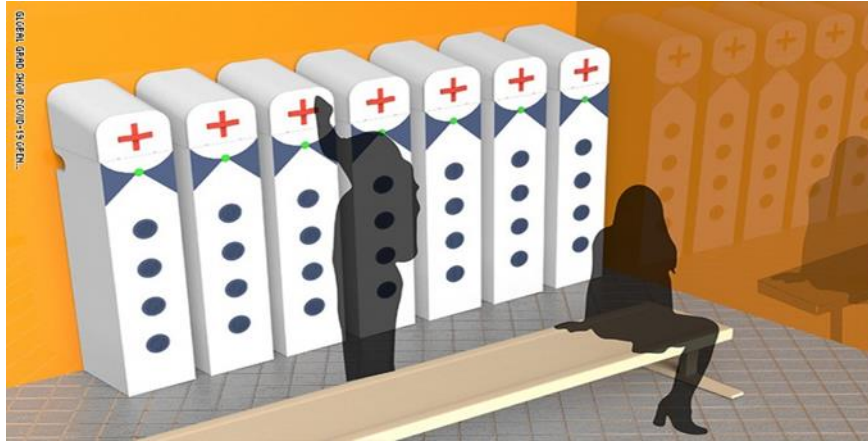


Figure (8) shows the "Steam Nurse" system, which is a smart locker that cleans hospital workers' uniforms with chemicals and ultraviolet rays

<https://arabic.cnn.com/style/article/2020/04/28/design-competition-coronavirus-spc-intl>

Second, the concept of space has changed:

As part of the precautionary measures to confront any epidemic, the internal void is transformed into multifunctional spaces. Therefore, smart vacuum technology is considered one of the most important foundations of technology and design in the coming years, and the division of internal spaces changed to provide the following according to the new situation:

- Cleaning entrance to receive any delivery services or store purchases or supplies.
- New technologies (smart space).
- Spaces created for the needs of home insulation
-

Design applications on changing the concept of space in design;

1. Design the "Locabox" space for receiving the required supplies



Figure (9) illustrates the change in the design concept of a supplies receiving space. "Locabox" is a common delivery warehouse where drivers can deliver supplies to multiple addresses simultaneously, and manage their risk of infection. Residents will collect their belongings during specified periods of time.

<https://hmcarchitects.com>

2. Home Stone Tent Design "Quarantent" :

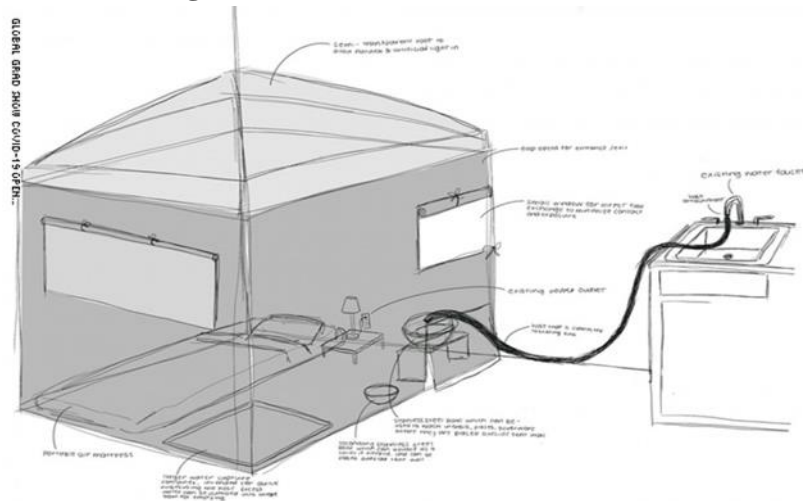


Figure (10) shows the possibility of dividing the space into multiple spaces, such as the stone tent inside the house, called "Quarantent", which allows isolation in a house inhabited by other people. Its design features a separate water connection, and a semi-transparent roof to let in natural light.

Global competition seeks designs to fight pandemic - CNN Style

3. The design of the interior design spaces has evolved to make the most of what is limited. Spending great time at home (studying online, working online, ...)



Figure (11) shows, the Japanese architectural firm "HOAP" used sliding barriers to divide this apartment in Tokyo, and control the spaces of the house to accommodate various activities from study to work to entertainment to

<https://www.regionalhousingauthority.org/home-ownership-assistance>

Third, the job concept has changed:

The concept of function has evolved for both the interior design elements (floors, walls, ceilings, " and for complementary interior design elements" furniture, lighting, ") and the concept of function has changed due to several factors of which:

-Technological development and its use to achieve interactive living compatible with the internal and external environment alike to meet the requirements of occupants of the vacuum, whether material or practical.

The necessity to keep pace with the development in the form and design of the internal space (residential, administrative, tourism, ...) to suit the precautionary measures for the place users .

A change in the functional style of the buildings followed, **and this change is represented in two axes:**

1. Overlapping of functions in buildings. .
2. Cancellation of some jobs. .

As the internal space of the house used to represent safety, comfort and privacy for its residents only Now with the social isolation imposed within precautionary measures for Coronavirus ^{١٩}, **all of the above has happened in addition to creating a space to practice various activities such as the following:**

- Work from home
- Receive an online education
- Doing sports activities
- Recreational activities...

Therefore, the division of spaces of residential origin, for example, must be reconsidered and a technology developed to develop all of the following:

The balcony of the house / garden of the house

- A place for sports activities
- A place to work from home
- A place to study (distance education)
- Provide good ventilation
- Provide good lighting
- Provide a suitable indoor plant environment

An application to changing the concept of the job of the inner space according to its nature

1- HiBed(smart bed)

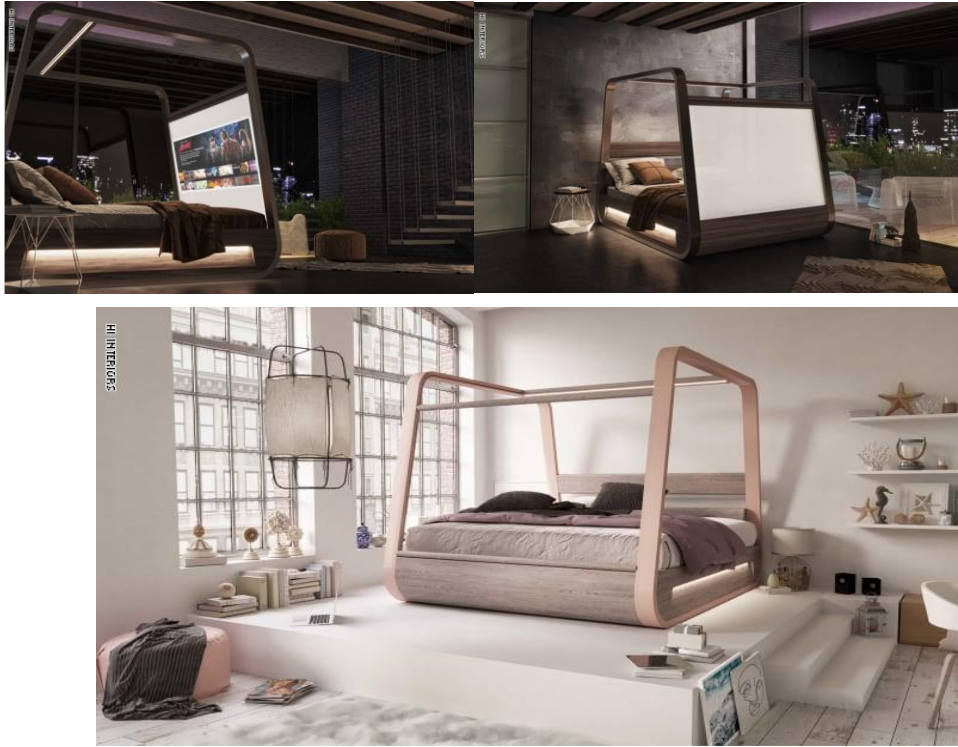
Designed by the architectural designer "Vibo Finilla" for the company "Hi-Interiors", to ensure that the user gets the best comfort, characterized by the following:

-With high-definition projector, ٧٠-inch screen, composite audio system, and invisible speakers.

-The bed contains a special adjustable lighting, an adjustable base, automatic blackout curtains, a voice control feature, and an installed Wi-Fi service. It has the feature to monitor the user's movements, and it automatically adjusts the temperature according to his desire.

The bed also features a "personal concierge service", which starts as soon as you wake up, and includes a smart alarm, weather updates, and traffic information.

The bed is also equipped with biometric screens that can track the user's weight.



Tech."HiBed" Figure (12) illustrates the <https://www.hi-interiors.com/hi-bed>

Fourth, changing the concept of the modulus:

- The term “module” was derived from the ancient Greek word “modulus,” which means a small dimension or unit of measure. A module gives the scale to the design.
- The concept of the modulus (network, unit of measurement, geometric shapes) has shifted in design and architecture. It is no longer dependent on Euclidean engineering concepts and special engineering theories. It has become dependent on a three-dimensional network, that is, from the concept of the medium in "Le Corbusier" to the influential and auxiliary information age. In the changing design configuration according to the precautionary measures to avoid the spread of epidemics.

Fifth: developing renewable ways to obtain energy:

The factor of air flow and ventilation is one of the most prominent characteristics of healthy building design, and it will undoubtedly be at the forefront of the important criteria that must be taken into account in the redesign in the stage of the spread of any epidemic, and since the quality of the air and the degree of its humidity in the building have a role in the reproduction of microbes, so it must be providing alternative solutions in every vacuum in case of cutting off energy and relying on renewable energy.

The following figure (13) shows one of the important solutions to save energy during the winter and summer seasons, especially during the spread of epidemics, which combines energy saving with economic savings for the residents of the place.

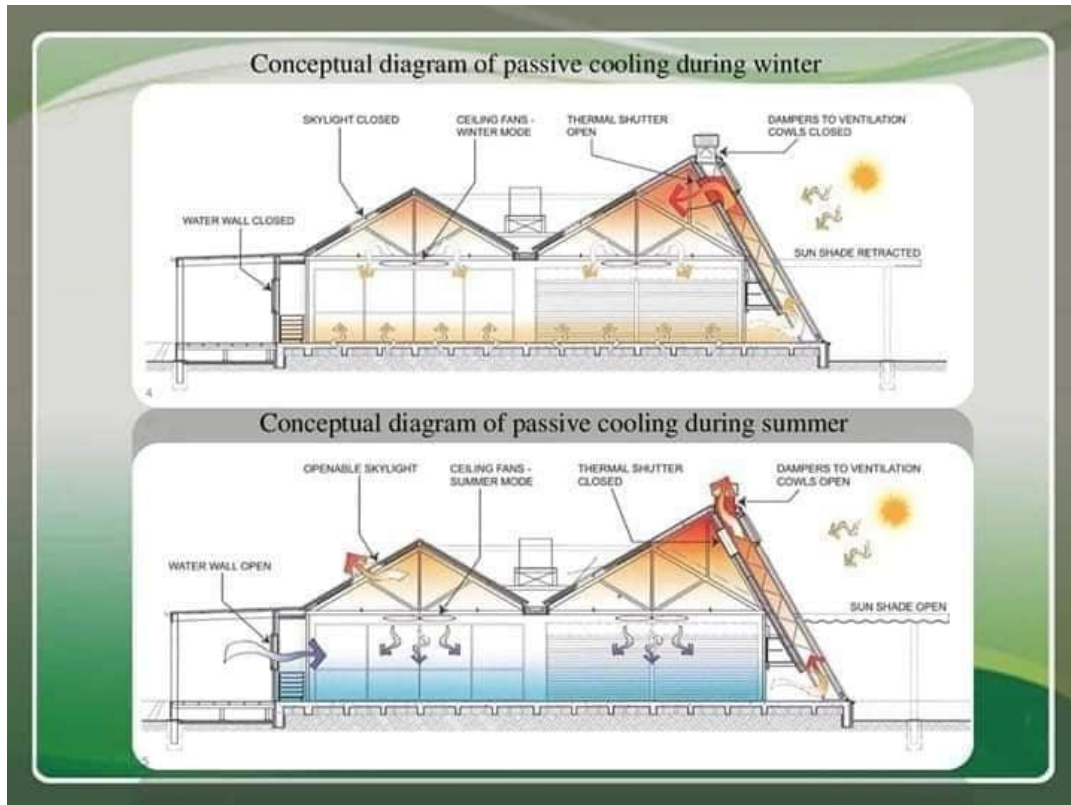


Figure (13)

<https://www.usgbc.org/projects>

Applications on the development of renewable ways to save energy inside the interior space:

Together, a team from three French and Italian universities designed a "solar tunnel" system that directs sunlight down from rooftops through pipes with reflective surfaces into the interior spaces for the people trapped inside during the lockdown.

Where the use of solar tunnels inside various spaces will transform into warmer and more attractive spaces, with beneficial effects on the health and psychology of vacuum users.

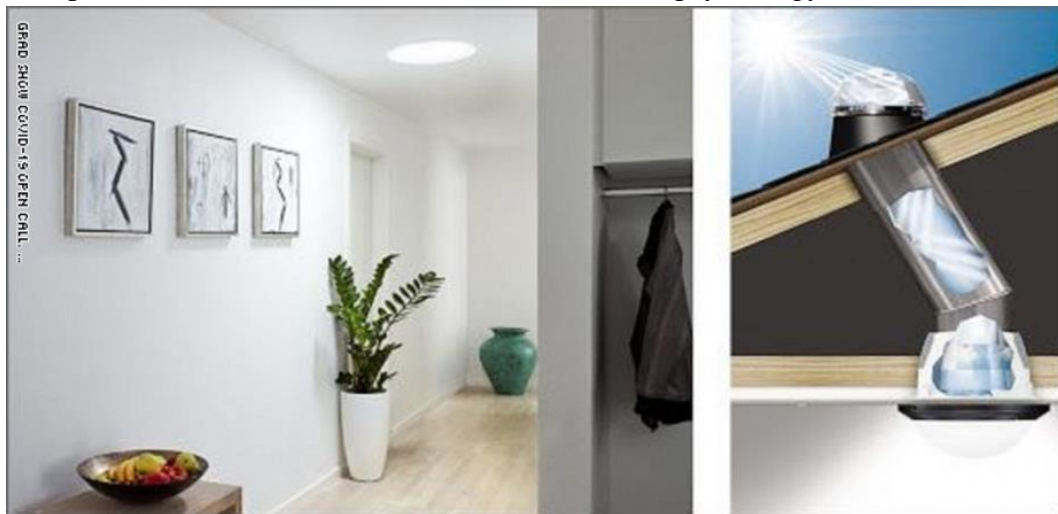


Figure (14) shows the "solar tunnel" that directs the sun's rays through tubes made of reflective materials from the roofs of buildings into the interior spaces in conjunction with the precautionary measures at the time of the spread of epidemics

<https://arabic.cnn.com/style/article/2020/04/28/design-competition-coronavirus-spc-intl>

Sixth: How to take advantage of traditional vacuums and develop them into renewable spaces according to epidemiological precautionary measures:

Some proposals will be clarified to develop the current vacuums to cope with the precautionary measures for the spread of any epidemic.

No.	In ancient times (before spread of epidemics)	Recently (after spread of epiemics)
1	A structural vacuum that depends on a number of limited activities	Variable space to suit many activities that dominate the flow Life for Contemporary Societies
2	High-rise buildings with the largest number of people in one place	High-rise buildings reduce connectivity for all that is used in multi-storey buildings as much as possible
3	Le Corbusier defined an inner space as a machine	It is the space that can interact with the environment, integrate and correspond with it continuously and has the ability to constantly renew according to the various activities developed
4	Not all interior design elements have been studied in accordance with health and safety regulations in times of epidemics	Begin to study all interior design elements according to health and safety rules in times of epidemics, such as how to avoid touching any public surfaces such as: <ul style="list-style-type: none"> - Elevator buttons - Doorknobs - The lighting switch - Doorbell buttons - Used materials and other tools that could transmit the infection
5	Sometimes there is no special entrance	Entrance equipped with sterilizing disinfectant (shoe disinfection - disinfection of clothes - disinfection of everything that enters the internal space)
6	Lack of concern at times for the existence of places for plants, internally or externally	The need to pay attention to the presence of places for plants in balconies and in the internal environment to help create spaces that are healthy and aesthetically pleasing

Results:

-As a result of precautionary measures to confront the spread of epidemics, there has been a great development in the concept of internal space (dynamic, smart, streamlined ...) from the interior design of traditional spaces.

-Sustainable environmental design at the time of the spread of epidemics is the fruit of the reconciliation contract between technology and the environment, and its impact on the design of interior space can be summarized in the following points:

2. The emergence of new concepts of Karaj to reach dynamic, formal and visual spaces coinciding with the precautionary measures to avoid the spread of epidemics.
3. Evolution in designing elements of the interior space and furniture (floors, walls, ceilings, ...) closely related to the environment.
The environment, especially when epidemics spread, depends on the principles and science of environmentally sustainable design.
4. The design of the internal space at the time of the spread of epidemics can be described as rational, romantic (space ... space) that integrates with everything.
5. Informing and interacting with it and responding to environmental, human, design and rational requirements, and that is through the use of modern technologies and information technology, and it is distinguished by being immortal).
6. The development of interior design concepts was closely linked to the surrounding environment, which is a mirror that reflects the vital systems of the organism, especially at a time of epidemics.

Recommendations:

Given that the goal of the research study is to serve both the designer and the recipient, and after exposure to the results of the previous study, the study recommends the following recommendations:

- Ministry of Planning,

- 1-Increasing awareness and advertising of environmental sustainable design technology and the importance of its application at the time of epidemics at the media and publishing houses level.
- 2-The need to pay attention to sustainable environmental design thinking in terms of elements, functions, configurations, and the distribution of spaces, especially at the time of the spread of epidemics.

- Researchers and academics,

- 1-The interior designer must not be separated from what the modern world presents in terms of science, systems, techniques and theses, and remains interactive and integrated with them, while following precautionary measures to prevent the spread of epidemics.
- 2-The need to pay attention to the design of the internal space at the time of the spread of epidemics, especially of three basic determinants (direct formation, indirect formation, advanced technology).

References:

- Novel Coronavirus (COVID-19) Pandemic: Built Environment Considerations To Reduce Transmission, Leslie Dietz, Patrick F. Horve, David A. Coil, Mark Fretz, Jonathan A. Eisen, Kevin Van Den Wymelenberg. DOI: 10.11-2019
- [-Novel Coronavirus \(COVID-19\) Pandemic: Built Environment Considerations To Reduce Transmission](#), Leslie Dietz, Patrick F. Horve, David A. Coil, Mark Fretz, Jonathan A. Eisen, Kevin Van Den Wymelenberg. DOI: 10.1128/mSystems.00245-20-2019
- Addington , M& Schodek,D,” smart materials and technologies for the architecture and design professions “ – Architecture press – Animprnt of - Elsevier – ٢٠٠٥

-Adams, W.M., "The Future of Sustainability: Re-thinking Environment and Development in the Twenty-first Century." Report of the IUCN Renowned Thinkers Meeting, ٢٩-٣١ January ٢٠٠٦, retrieved , ٢٠٠٩

-file:///C:/Users/dell/Downloads/2ndEditionRegenerative_Design_and_Development.pdf

- www.archnet.org

- <http://www.designbuzz.com/entry/interactive-faade-shifts-to-ensure-optimal-lightwith-shifting-sun/>

- <http://www.gizmowatch.com/entry/touchmagix-media-unveils-magixtable-world-s-thinnest-multitouch-interactive-table/>

- http://the-artists.org/artist/Olafur_Eliasson.html

- http://www.archdaily.com/٤٣٣٣٦/the-yas-hotel-asymptote/yas_d٠١٨/

- https://www.researchgate.net/profile/Pamela_Mang/publication/321156684_Update_Regenerative_Development_and_Design_2nd_edition/links/5a11a9310f7e9bd1b2c0bc9c/Update-Regenerative-Development-and-Design-2nd-edition.pdf

1. - <http://www.arkitectrue.com/-6/4/2020-10.00PM>

2. - <http://environmentalresponse.wordpress.com/group-٠٢/-6/4/2020-7.00PM>

3. <https://www.msmanuals.com/ar/home/%D8%AD%D8%A7%-%8/4/2020-8.00PM>

4. <https://www.cdc.gov/coronavirus/2019-ncov/downloads/2019-ncov-factsheet.pdf> - 2/4/2020- 10.00PM

5. <https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200423-sitrep-94-covid-19.pdf-10/9/2020-5.00PM>

¹ H5N1 is a type of influenza virus that causes a highly infectious, severe respiratory disease in birds called avian influenza (or "bird flu").

² The Organization for Economic Co-operation and Development (**OECD**) is an international organisation that works to build better policies for better lives. Our goal is to shape policies that foster prosperity, equality, opportunity and well-being for all.