

# Reflection Paper

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## 1. The relationship between research and design

My research question is 'What are Biophilic design solutions that can be used in interior and facade of the nursery area of the AMC hospital to maximize energy efficiency of the building?'

My first intention for the project is to create a healing environment for the patient in the hospital for faster recovery. I came across the concept of biophilic design, which had been proven to help increase the recovery rate of patients. Therefore, I start my research on what the biophilic design solutions are, and the principles behind them. I went to London to attend a workshop about biophilic design and I was told about the six different biophilic elements, and biophilic design can be illustrated by remembering our last encounter with the nature, the things we see, we hear, we smell, we touch, and the change of emotions in our head. Biophilic design is about how we can bring all those good qualities into our built environment, so that even when we are in an indoor environment we feel like we are in the outdoor space. There are six main biophilic elements that drive the biophilic design. I have summarized all the biophilic design solutions that can help increase energy efficiency in the building. I try to evaluate each of them based on costs, performance, effectiveness and ease of installation to figure out which one will work the best on the AMC building. At last I incorporated three strategies into the design to create an integrated system to facilitate both the biophilic benefits and energy efficiency. These are

1. The prefabrication of modular balconies to create single bed patient rooms.(Fig 1)
2. The removal of part of the building to create outdoor space
3. The rearrangement of program to create more single-bed patient rooms, a hierarchy of privacy and more community space.(Fig 2)

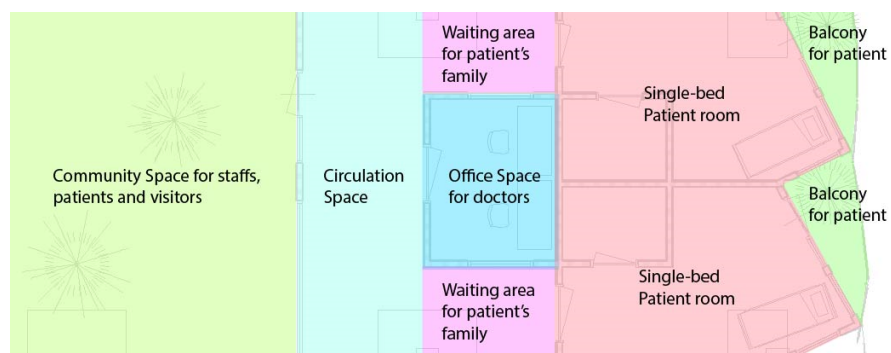


Fig 1 & 2 Diagram showing prefabrication of modular balcony and rearrangement of program

These three strategies work together to increase energy efficiency by

- a. Allowing more sunlight to enter the building by reducing the usage of artificial light
- b. Creating a natural flow of air as natural ventilation to assist mechanical ventilation, and to facilitate cooling in summer time

The interventions also help to encourage the interaction between the staffs, the patients and the visitors. The space help to facilitate a faster diagnosis of patients and discussion with patient's family on treatment decision.

## **2. The relationship between my project topic, my studio topic, my master track (Architecture), and my master programme (MSc AUBS)**

My project topic is 'To create the optimum biophilic environment for the patients, staffs and visitors in the nursery area of AMC'

The studio Architectural Engineering has a focus on using new technology as inspiration, to contribute to the architectural design and improving social issues.

The new technology that I am using is the biophilic intervention, as a tool to shape the design ,to help the patients in AMC to heal in a faster process, to motivate the staff and to give the visitors a unique hospital experience. The intervention at the same time can help increase energy efficiency.

From the biophilic element that I have chosen I have evolved the idea into two techniques, modifying the façade of the patients' room and the central atrium space. For the patient room the old façade was removed, replaced by new prefabricated modular balcony. The new balcony was made in modular units for easy installation and maintenance. The frameworks are also made in a flexible way so that the panels can be replaced or changed from time to time. The balcony helps to contribute to the biophilic healing effect by enhancing the connection between the patients and the nature, with easily accessed outdoor space. It also allows more sunlight to reach the patient room, together with the openable balcony door and window ventilators, help increase energy efficiency of the building. (Fig 3)

For the central atrium space part of building is removed to create outdoor space and double height indoor atrium area with double height glass curtain façade. The idea is to allow more sunlight to enter deeper into the building, with support of natural ventilation, so that even you are inside the hospital you will feel like you are in the outdoor space. This also increases energy efficiency of the building.

In relationship to the architecture track, it focuses in spatial aspects, functional aspects, material and technical aspect, contextual and social culture aspect.

The experience of the hospital by the end user is a focus for the project as well, in order to provide the best experience for the staffs, the patients and the visitors. The circulation is made for easy wayfinding, with corridors open to the outdoor space. For the functional aspects the program is rearranged for the convenience of staffs. The nursing stations are put in front of the patients room, and were made transparent, so as to enhance interaction between the staffs and the patients. Between the nursing station will be waiting area for the visitors.(Fig 4) ,to create space for discussion

between the patients' family and the staffs. The material used were chosen based on their biophilic values. Therefore, wood flooring and wood wall finishes were used in the patients' room and balcony. The atrium space used curved double height glass curtain wall to create organic form to imitate natural shape. (Fig 5) For the larger contextual aspect, the building respond to the site by having the sight connection between the patient room and the surrounding. The visitors will be easily able to identify the location of the patient room that they are going to visit. The new façade also relate to the new entrance that the hospital is going to build.



Fig 3, 4 & 5 Rendering showing the Patient Room, the Waiting Area and the Atrium Cafeteria Space

**3. Elaboration on research method and approach in relation to the graduation studio methodical line of inquiry, reflecting thereby upon the scientific relevance of the work**

The research method is done by attending workshops, case studies, site visit and interviews.

In order to have a better understanding of my project topic I have gone to London to attend a workshop held by Amanda Sturgeon, the CEO of the international Living Future Institute(ILFI). She has organized the biophilic design elements into six different attributes based on Stephen Kellert's book 'Biophilic Design'. Through studying different case studies, I found out how biophilic designs were implemented in different ways in building projects.

To research about the energy reduction technique in relation to biophilic elements I have examined what are the climatic requirements for a general hospital , and also examined case studies which involve reduction in energy consumption technology together with biophilic features, the result were combined with the biophilic design principles , in order to develop a biophilic technique which can maximize energy efficiency in AMC.

For a better understanding of the site context , the site Research of AMC was done by site visit, interviewing with the facility manager of AMC, and study of site and building drawings. The old regulation and building development were also studied in the research processes.

The result of the research was summarized in the research paper, with analysis drawings of the current building plans and sections, and a table (Table 1) summarized the different biophilic intervention and their relationship to energy efficiency. The table also involved an evaluation system. The nine parameters are cost efficiency, energy efficiency, maintenance efficiency, sustainability, expansion potential, comfort performance, biophilic values, psychological values and adaptability in ongoing hospital operation. During the design process every decision making was reflected to the table and the evaluation system, in order to help in finding out a better design solution.



RELATIONSHIP WITH BIOPHILIC TECHNOLOGY	BIOPHILIC ELEMENTS	TEMPERATURE (HEATING/ COOLING)	WATER	LIGHT	AIR	APPLICATION TO AMC	Evaluation
BIOWALL SYSTEM	ENVIRONMENTAL FEATURES(PLANTS)	NATURAL AIR COOLING		LIVING WALL IN TITIE FACADE CAN HELP SUMMER SHADING	IMPROVED AIR QUALITY	APPLICATION IN THE CENTRAL ATRIUM OF BLOCK G, TO ACHIEVE: -VISUAL CONNECTION TO NATURE FROM PATIENT ROOMS -COOLING DOWN OF ATRIUM SPACE	
LIGHT VENT	LIGHT + SPACE (NATURAL LIGHT, DIFFUSED LIGHT)	DRAW NATURAL COLD AIR IN FOR COOLING		TRANSMIT DAYLIGHT DEEP INTO THE BUILDING	MINIMIZE MECHANICAL VENTILATION BY MAXIMIZING NATURAL VENTILATION	APPLICATION OF LIGHT VENT INTO 7th and 8th FLOOR OF BLOCK G, TO ACHIEVE: -HIGHER AND DEEPER SUNLIGHT ENTRY -NATURAL VENTILATION BY DRAWING COOL AIR FROM 6th and 7th FLOOR	
RAIN VEIL	ENVIRONMENTAL FEATURES(WATER)	NATURAL COOLING BY WATER FLOW	COLLECT AND REUSE OF STORMWATER AND RAINWATER			APPLICATION OF RAIN VEIL FROM 3rd to 6th Floor OF BLOCK G, TO ACHIEVE: -REDUCTION IN CONSUMPTION OF WATER BY REUSING RAINWATER	
VEGETATIVE ROOF	EVOLVED HUMAN-NATURE RELATIONSHIPS (CHANGE AND METAMORPHOSIS)	REDUCE HEAT ISLAND EFFECT	SLOW DOWN THE FLOW OF RAINWATER		IMPROVED AIR QUALITY	APPLICATION OF GREEN ROOF ON THE ROOFTOP OF BUILDING G, TO SLOW DOWN THE RAINWATER FLOW AND AND COOL DOWN THE TOOFFLOOR AREA	
CONSTRUCTED WETLANDS	PLACE-BASED RELATIONSHIPS (LANDSCAPE ECOLOGY)		PURIFIED AND FILTERED WASTEWATER		IMPROVED AIR QUALITY	RECONSTRUCTING 4th TO 9th FLOOR OF BLOCK G INTO A STEPPING LANDSCAPE, TO ACHIEVE: -FILTERED RAINWATER -SUMMER SHADING AND WINTER SOLAR GAIN	
FAN-SHAPED DESIGN	NATURAL SHAPES + FORMS (RESISTING STRAIGHT LINES)	SHADING HELPS AVOID OVERHEATING, CATCH THE WIND FOR COOLING		ACHIEVED OPTIMIZED SUNLIGHT WHILE REDUCING G1 A7F	ALLOW AIR TO FLOW IN AS VENTURI EFFECT, WHICH INCREASE AIR VELOCITY WITH MECHANICAL VENTILATION	APPLICATION OF FAN SHAPE DESIGN IN FRONT OF PATIENTS ROOM, SO TO ACHIEVE SUMMER SHADING TO PATIENTS, AND NATURAL VENTILATION	

Table 1. Table showing the relationship between biophilic elements and energy through the different biophilic technology, their application into to AMC and corresponding evaluation

#### **4. The graduation project and the wider social, professional and scientific framework, touching upon the transferability of the project results**

My project's aim is to design a prototype, which can be used in many similar scenarios in hospital buildings to increase the recovery rate of patients and to save energy. The prefabrication of modular balconies can be easily installed onto a vernacular hospital façade. The result is to create a hospital which benefits the staff, the patients and the visitors. It also helps to bring profit to the hospital.

Besides, the project aim is to raise the social awareness of the benefits of using biophilic design, so as to encourage architects, interior designer and engineer to use incorporate biophilic elements into their design process. Too often nowadays in our contemporary world the buildings do not give us a chance to connect with nature, building with no windows, no fresh air, view of nothing. Because majority of us spent 90 percent of our time every day in indoor environment, most of us are basically cut off from the natural world. The disconnection between human and nature bring massive consequences to our society, especially in children we see more of them suffering from nature deficit disorder, physical, psychological and behavioral problems, including obesity, depression and attention disorders. Therefore Biophilic design should be implemented in a larger social context, from small interior design in shops and restaurants, to public building such as school, library, airport, and to an even bigger scale in city urban planning .

This project demonstrates a translation of from biophilia concept into practical biophilic intervention to be used in the hospital. It demonstrates the varieties of biophilic design, which are not only limited to planting, but there are also 'lesser known' biophilic design elements to contribute to the human experience. The goal is to give an example of the potential of biophilic design, and it can be experiment more in the future. Every time biophilic design is implemented the result can be measured and quantified, and become an example of Evidence-Based design, in which design decisions in the future can be made based on existing evidence from research .

#### **5. The ethical issues and dilemmas that have encountered, and lessons learnt**

During the research I met with the staff working at the hospital and the person representing the hospital staff authority. There is a difference in point of view when it comes to the renovation of the AMC hospital. The hospital authority would like to maintain the historical value of the building and to implement the least intervention. On the other hand, during the interview of the staff, it became clear that he wanted a refreshed working environment which could only be done by applying new materials and new kind of space for motivation. Therefore, I decided to have my own statement of putting end-user first in the design process, and I believe biophilic design will be the most efficient tool for me to achieve the goal.

However, utilizing biophilic design sometimes do go into conflict with economic demands, client demand and conventional practice pressure. I think the dilemmas lie in between the practical limitation against the true vision that the architect wants to achieve. If the design of the building focus too much on the vision and ideas, it may lose its functionality and efficiency. But on the other hand if

the design of the building only focus on its functional and physical site limitation, it will result in a generic design with no breakthrough. But throughout the project I have learned to question about the habitual way of designing and constructing buildings, at the same time to take care of the existing building principles, how to strives a balance between practicality and design vision. I do find out the potential of biophilic design in turning the usual way of design upside down, to inspire technical innovation, and to make a breakthrough which can create greater end-result then the drawbacks. In my point of view biophilic design is becoming a very reasonable investment.

Besides, I realized that as an architect there will always be many different stakeholders involved in the design decisions, and not everyone's preferences can always be satisfied. It is good to begin with setting up a framework on the scales, the proposition and the target groups. These criteria can make it clear on making design decisions throughout the whole design process and to negotiate with different parties. Biophilic design will surely be one of my major guide in my future career as an architect, with the commitment and vision to create the change in the society, a harmony of building with nature which allow us to be healthier and happier.