



“An exploration of the interior design process focusing on the intrusion of Biophilic Design in the interiors of a healthcare facility to promote patient well-being: A case study. ”

By

EDLASIA SAVIA MAVOVA FILIPE

████████████████████

A research project submitted in fulfilment of the requirements for the
BA Honours degree in Interior Design
at the
Independent Institute of Education: Vega School

Supervisor: JD Eksteen

Submission date: December 2020

████████████████████

████████

Wordcount: 11996

ABSTRACT

The design process of the healthcare facility is a very complex process, which focuses on the wellbeing of the patient and staff member. Numerous research shows that contact with the natural environment helps in the recovery process of the patients. With that, we will look at the application of biophilic design, which focused on incorporating the experience of nature and their respective attributes, and the 14 patterns of biophilic design in the built environment. Looking at hospitals that focused on the application of biophilic design, the study will use the case study approach and unobtrusive research to collect the data. Subsequently, qualitative content analysis, visual analysis and conceptual analysis will be used to analyse the collected data. The first case study is performed on the Khoo Teck Puat Hospital situated in Singapore, an international hospital that focuses on the application of biophilic design principles as its main concept. The second case study is performed on the Umkhumbane Community Health Centre situated in Durban, a South African hospital that focuses on the application of biophilic design principles as its main concept. Both hospitals focus mainly on the application of design strategies that increase direct contact with the natural environment.

KEYWORDS: Healthcare Facility, Biophilic Design, Design Process; Patient Well-being.

DECLARATION BY CANDIDATE

I, Edlasia Savia Mavova Filipe, hereby declare that the Research Report submitted for the qualification BA Honours degree in Interior Design, at Vega, to The Independent Institute of Education is my own work and has not previously been submitted to another University or Higher Education Institution for a postgraduate qualification.



14.12.2020

Signature

Date

TABLE OF CONTENT

	Page
ABSTRACT	I
DECLARATION BY CANDIDATE	II
TABLE OF CONTENT	III
LIST OF FIGURES	VII
LIST OF TABLES	IX
LIST OF APPENDICES	X
LIST OF ABBREVIATIONS	XI
LIST OF TERMINOLOGY	XI
CHAPTER 1: PROPOSAL AND ORIENTATION OF THE STUDY	1
1.1 CONTEXTUALISATION OF THE STUDY.....	1
1.2 RATIONALE.....	3
1.3 PROBLEM STATEMENT.....	3
1.4 PURPOSE STATEMENT.....	4
1.5 RESEARCH GOALS, AIM AND OBJECTIVES.....	4
1.5.1 Research Questions.....	4
1.5.2 Aim and Objectives.....	5
1.6 STRUCTURE OF THE RESEARCH PAPER.....	6
1.7 OUTLINE OF CHAPTERS.....	7
CHAPTER 2: LITERATURE REVIEW	8
2.1 INTRODUCTION.....	8
2.2 CONCEPTUALISATION.....	9
2.3 THEORETICAL FOUNDATION.....	10

2.4 BIOPHILIA AND BIOPHILIC DESIGN.....	12
2.4.1 Biophilia.....	12
2.4.2 Biophilic Design.....	12
2.4.3 The Application of Biophilic Design.....	13
2.4.3.1 The Experiences and Attributes of Biophilic Design.....	15
2.4.3.2 The 14 Patterns of Biophilic Design.....	16
2.5 THE DESIGN PROCESS OF A HEALTHCARE FACILITY.....	18
2.5.1 The Design of a Healthcare Facility.....	18
2.5.2 The Guiding Theories and Principles.....	18
2.5.3 The Design Process of a Healthcare Facility.....	19
2.6 BIOPHILIC DESIGN AND HEALTHCARE FACILITY.....	24
2.6.1 Biophilic Design in Healthcare Facility.....	24
2.6.2 The Healing Environment.....	24
CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY.....	26
3.1 INTRODUCTION.....	26
3.2 DESIGN OF THE STUDY.....	26
3.2.1 Research Design and Paradigm.....	26
3.3 SAMPLE SELECTION.....	28
3.4 DATA COLLECTION.....	30
3.4.1 Data Collection Tool.....	30
3.4.2 Method of Collection.....	31
3.5 DATA ANALYSIS.....	32
3.5.1 Data Analysis Tool.....	32
3.5.2 Method of Analysis.....	33

3.6 CHAPTER SUMMARY.....	35
CHAPTER 4: FINDINGS, INTERPRETATIONS AND DISCUSSION.....	36
4.1 INTRODUCTION.....	36
4.2 PRESENTATION AND DISCUSSION OF FINDINGS.....	37
4.2.1 Khoo Teck Puat Hospital.....	37
4.2.1.1 Justification of the Case Study.....	37
4.2.1.2 Visual Analysis.....	38
4.2.1.3 Discussion of Findings.....	43
4.2.1.3.1 The Three Experiences of nature.....	43
4.2.1.3.2 The 14 Patterns of Biophilic Design Categories.....	46
4.2.2 Umkhumbane Community Health Centre.....	48
4.2.2.1 Justification of the Case Study.....	48
4.2.2.2 Visual Analysis.....	48
4.2.2.3 Discussion of Findings.....	53
4.2.2.3.1 The Three Experiences of Biophilic Design.....	53
4.2.2.3.2 The 14 Patterns of Biophilic Design Categories.....	55
4.3 CROSS - SECTION ANALYSIS.....	57
4.4 VALIDITY AND TRUSTWORTHINESS.....	58
4.5 CHAPTER SUMMARY.....	58
CHAPTER 5: CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS.....	59
5.1 INTRODUCTION.....	59
5.2 CONCLUSION DRAWN FROM THE FINDINGS AND IMPLICATIONS.....	59
5.3 CONTRIBUTION TO THE FIELD.....	62
5.4 ETHICAL IMPLICATIONS.....	63
5.5 FURTHER RESEARCH AND CRITIQUE OF THE RESEARCH.....	64
REFERENCE LIST.....	65
APPENDIX A - CONCEPT DOCUMENT TEMPLATE.....	73

APPENDIX B – IIE ETHICAL CLEARANCE.....	74
---	----

LIST OF FIGURES

	Page
Figure 1: Filipe, E. 2020. Outline of research paper chapters.....	7
Figure 2: Filipe, E. 2020. Outline of the literature review. Diagram visualised by the author.....	8
Figure 3: Filipe, E. 2020. Conceptualisation of key terms, diagram visualised by the author.....	9
Figure 4: Filipe, E. 2020. Theoretical foundation of the study, diagram visualised by the author.....	10
Figure 5: Filipe, E. 2020. IT'S Biofilia Office / IT'S Informov (ArchDaily, 2019), diagram visualised by the author.....	13
Figure 6: Filipe, E. 2020. The 6 elements of biophilic design and the related 70 attributes (Kellert, 2008), diagram visualised by the author.....	14
Figure 7: Filipe, E. 2020. The 3 experiences of Biophilic Design (Kellert and Calabrese, 2015), diagram visualised by the author.....	15
Figure 8: Filipe, 2020. The experiences of nature, diagram visualised by the author.....	16
Figure 9: Filipe, E. 2020. The 14 pattern of Biophilic Design (Downton, Jones, Zeunert and Roös, 2017), diagram visualised by the author.....	17
Figure 10: Filipe, E. 2020. Design process stage infographic Carpmann and Grant, 2016) diagram visualised by the author.....	21
Figure 11: Filipe, E. 2020. The 7 stages of a design process (Carpman and Grant, 2016), diagram visualised by the author.....	23
Figure 12: Filipe, E. The Maggie's Leeds Centre. The St. James's University Hospital in Leeds (ArchDaily, 2020), diagram visualised by the author.....	25
Figure 13: Filipe, E.2020. Research Design.....	27
Figure 14: Filipe, E. 2020. Population Sample Diagram.....	29
Figure 15: Filipe, E. 2020. Design of the Study.....	34
Figure 16: Filipe, E. 2020. Khoo Teck Puat Hospital Technical Drawings, diagram visualised by the author.....	39

Figure 17: Filipe, E. 2020. Khoo Teck Puat Hospital Exterior Spaces, diagram visualised by the author.....	40
Figure 18: Filipe, E. 2020. Khoo Teck Puat Hospital Interior Spaces, public areas, diagram visualised by the author.....	41
Figure 19: Filipe, E. 2020. Khoo Teck Puat Hospital Interior Spaces, private areas, diagram visualised by the author.....	42
Figure 20: Filipe, 2020. Khoo Teck Puat Hospital, The 3 experiences of nature overall diagram.....	45
Figure 21: Filipe, 2020. Khoo Teck Puat Hospital, The 14 Patterns of Biophilic Design Categories, overall diagram.....	47
Figure 22: Filipe, E. 2020. Umkhumbane Community Health Centre Technical Drawings, diagram visualised by the author.....	49
Figure 23: Filipe, E. 2020. Umkhumbane Community Health Centre Exterior Spaces, diagram visualised by the author.....	50
Figure 24: Filipe, E. 2020. Umkhumbane Community Health Centre Interior Spaces, main circulation, diagram visualised by the author.....	51
Figure 25: Filipe, E. 2020. Umkhumbane Community Health Centre Interior Spaces, courtyard, diagram visualised by the author.....	52
Figure 26: Filipe, 2020, Umkhumbane Community Health Centre, The Three Experiences of nature overall diagram.....	54
Figure 27: Filipe, E. 2020. Umkhumbane Community Health Centre, The 14 Patterns of Biophilic Design Categories overall diagram.....	56
Figure 28: Filipe, E. 2020. Cross – section Analysis, diagram visualised by the author.....	57

LIST OF TABLES

	Page
Table 1: Alignment and summary of research paper.....	6
Table 2: The eight design processes developed by The Royal Institute of British Architects.....	19
Table 3: Visual Analysis codes and colours system.....	37

LIST OF APPENDICES

	Page
APPENDIX A - REPORT SUMMARY DOCUMENT TABLE.....	73
APPENDIX B – IIE ETHICAL CLEARANCE.....	74

LIST OF ABBREVIATIONS

PSD	Psychosocially Supportive Design
EBD	Evidence-Based Design

LIST OF TERMINOLOGY

Biophilia	It is the inherent human inclination to affiliate with nature (Kellert & Calabrese 2015).
Biophilic Design	It is the deliberate attempt to translate an understanding of the inherent human affinity to affiliate with natural systems and processes into the design of the built environment (Kellert, 2008).
Evidence-Based Design	The interactive decision-making process that begins with the analysis of current best evidence from an organization as well as from the field (Cama, 2009).
Healing Environment	The overall environment, both physical and non-physical, created to aid the recovery process (Ghazali and Abbas, 2017).
Healthcare	The service of providing medical care (Oxford English Dictionary, 2010).
Psychosocially Supportive Design	It helps healthcare designers and planners to understand how the physical environment of the healthcare facility can provide wellness in promoting health for both patient and the staff (Dilani, 2001).
Therapeutic Design	The design of outdoor and indoor spaces that aim to have biophilic environmental design principles in mind, and highlighting the fact that we need sequenced spaces in the hospital (Jiang and Verderber, 2015)

CHAPTER 1: PROPOSAL AND ORIENTATION OF THE STUDY

1.1 CONTEXTUALISATION OF THE STUDY

The connection between human and nature is a very important aspect in the built environment so that individuals can have good health and it allows them to be more productive in their activities (Beatley, 2011). The myrmecologist and conservationist E. O. Wilson popularized the term biophilia, who describe it as the need for the human to connect with nature (Beatley, 2011). The study focus on analysing the interior of a healthcare facility, to demonstrate how they applied the experiences and attributes of biophilic design. In addition, we will demonstrate how they manage to create a space that contributes to the healing process and wellbeing the user. The design approach used in the built environment, to help human to connect with nature is known as biophilic design (Kellert, 2008). The approach focuses on understanding the attempt to demonstrate the connection of human to nature system and processes in the built environment (Kellert, 2008). In the research document ``The Practice of Biophilic Design`` written by Stephen Kellert and Elizabeth Calabrese (2015), it shows the experiences and attributes of biophilic design.

The connection between the process of healing and nature was lost because of the technical approaches, such as surgery; medicines; drugs and x-rays, because they are a requirement in the interior of a healthcare facility (Marcus and Barnes, 1999). The design of a healthcare facility focused traditionally on providing functionality inside the space (Ulrich, 1997). Constant changes keep happening in this industry, specifically on the type of services that they deliver, and they happen because of the expectation that the patients have regarding the type of services, the development of technology, the vast information that people find on the internet and the holistic approach health and wellbeing concerns (Lee, 2011). With the rapid development of medical technology and the changes in the user's profiles, it is better to provide new ways to deliver care and provide spaces that make possible to implement new activities (Caixeta and Fabricio, 2012).

Designers have an important role in the healthcare field, having the same role as the people that work directly with the patients, to help to make people healthier (Jones, 2013). It is important to support new intervention that it will help to improve this field by using methods that help the design process because it can be very complex (Caixeta and Fabricio, 2012). Taking into consideration all the medical technology that the facility needs and the flexibility of the space, during the design, is very important (Carpman and Grant, 2016).

Subsequently, Ulrich (1997) mention that the design should move from the functionality of the space and focus more on providing space that provides health and wellness, a place that people can cope with stress. Two emerging fields are available and connected to the healthcare industry. The first theory is psychosocially supportive design (PSD) and the second theory is evidence-based design (EBD)

A study monitoring the recovery of patients while looking at vegetation and others at building showed that patients that were looking at vegetation had a fast recovery process (Marcus and Barnes, 1995). The research will focus on exploring the intrusion of biophilic design in healthcare facilities and focusing on the creation of spaces that contribute to the healing process and wellbeing of the patients and the staff member.

1.2 RATIONALE

The reason for this particular research is to show the benefits of the natural environment in the healthcare facilities, and the influence of the connection have in the recovery of the patients. In addition, having the opportunity to look at the theory of biophilia and the application of the concept of biophilic design, and their impact in the hospital.

The design of a healthcare facility is a very complicated area that all the investigation that focuses on the wellbeing of the patients is very important. The design of a healthcare facility is a very complex and with different aspects to take in consideration and it is in constant development, specifically in the technology, the equipment and methods (Caixeta and Fabricio, 2012). It is important to continue doing research that looks for ways to increase the experience of long and short-term occupants.

The study will on providing academic materials and insight for the students on the design of a healthcare facility. For the community, the study will provide insight, to design a facility that they can provide a good experience. Lastly, for the industry, the study will provide relevant materials in terms of gaining more insight into new theories and practices.

1.3 PROBLEM STATEMENT

Healthcare facilities have changed in the past decades, and it all due to the constant development of technology, the services that the space need and the different rooms that the space require (Lee, 2011). The design of a healthcare facility focused traditionally on providing functional facilities, such as spaces for laboratories and equipment and spaces for easy movement (Ulrich, 1997). However, the design should move from functionality and focus more on providing space that is to promote wellness for the patients (Ulrich, 1997).

The design process should focus mainly on the wellbeing of the patient, doctors and staff member. A very important aspect of the interior designers is to take in consideration how the users experience the space. A new theory walks closely with the design of a healthcare facility and is called evidence-based design.

One aspect to consider when we want to reduce stress is to increase the connection with nature by introducing natural environments; it will help on the healing process by applying the principles and theories of Biophilic Design in the interior a healthcare facility (Marcus, 2007). Kellert and Calabrese (2015) highlight the fact that exposure to the natural environment helps the patient in their recovering process and create an environment that is health to work. They said that “in the healthcare field, a wide range of studies have reported exposure to nature can reduce stress, lower blood pressure, provide pain relief, improve illness recovery, accelerate healing, enhance staff morale and performance, and lead to fewer conflicts between patients and staff” (Kellert and Calabrese, 2015:4).

1.4 PURPOSE STATEMENT

The purpose of this study is to explore the application of biophilic design principles and theories in the design of a healthcare facility. The study will focus on guiding on how designers and architects address this issue, with the purpose to increase the wellbeing of the patients. Subsequently, the demonstration of the impact of the natural environment on the occupants of the hospital and they can be an appropriated space for healing. Lastly, we will look at the guiding principles and theories of the design of a healthcare facility, looking at the two emerging fields that are part of this industry psychosocially supportive design (PSD) and evidence-based design (EBD).

1.5 RESEARCH GOALS, AIM AND OBJECTIVES

1.5.1 Research Questions

- Primary Research Question:

The following is the primary research question of the study:

How can biophilic design be included in the interior design process of the interiors of healthcare facilities to promote patient well-being?

- Secondary Research Question:

In addition, the secondary research questions of the study are:

1. What are the guiding principles used in the application of biophilic design in the built environment?
2. What are the guiding theories used in the design process of a healthcare facility?
3. How are the guiding principles, used in the application of biophilic design, applied in the interior of a healthcare facility to promote the patients?

1.5.2 Aim and Objectives

This study aims to explore the interior design process focusing on the intrusion of biophilic design, used by interior designers and architects, in the design of a healthcare facility.

AIM OF THE STUDY: To explore the interior design process of a healthcare facility and the application of biophilic design in the interior of the facility.

Objective 1: To explore the guiding principles for the application of biophilic design in the built environment.

Objective 2: To identify the guiding theories used in the design process of a healthcare facility.

Objective 3: To explore the application of the guiding principles of biophilic design in the design of a healthcare facility.

1.6 STRUCTURE OF THE RESEARCH PAPER

In table 1, it is a summary of the research paper and highlights the alignment between the research questions, aim, objectives and methodology.

Research Questions	Aim & Objectives	Research Method & Data Collection	Data Analyses	CH
Proposal and Orientation of the study				1
Primary Question How can biophilic design be included in the interior design process of the interiors of healthcare facilities to promote patient well-being?	Aim To explore the interior design process of a healthcare facility and the application of biophilic design in the interior of the facility.	Research Method Two architectural case studies. One case study will be performed on an international hospital that focused on applying biophilic design interventions. One case study will be performed on a local, South African, hospital that focused on applying biophilic design interventions. Coming from academically credible internet sources.	Data Analysis Case study research and unobtrusive research to the two case studies by means of content or textual analysis, conceptual analysis and Visual data analysis, on the two case studies and cross-case analysis.	2,3,4
Question 1 What are the guiding principles used in the application of biophilic design in the built environment?	Objective 1 To explore the guiding principles for the application of biophilic design in the built environment.	Research Method Literature Review. A summary of the information available	Data Analysis Unobtrusive research to the two case studies by means of content or textual analysis and conceptual analysis.	2,3,4
Question 2 What are the guiding theories used in the design process of a healthcare facility?	Objective 2 To identify the guiding theories used in the design process of a healthcare facility.	Research Method Literature Review. A summary of the information available.	Data Analysis Unobtrusive research to the two case studies by means of content or textual analysis and conceptual analysis.	2,3,4
Question 3 How are the guiding principles, used in the application of biophilic design, applied in the interior of a healthcare facility to promote the patients?	Objective 3 To explore the application of the guiding principles of biophilic design in the design of a healthcare facility.	Research Method Two architectural case studies. One case study will be performed on an international hospital that focused on applying biophilic design interventions. One case study will be performed on a local, South African, hospital that focused on applying biophilic design interventions. Coming from academically credible internet sources.	Data Analysis Case study research and unobtrusive research to the two case studies by means of content or textual analysis, conceptual analysis and Visual data analysis, on the two case studies and cross-case analysis.	2,3,4
Conclusion, implications and limitations				5

Table 1: Alignment and summary of the research paper (Filipe, 2020)

OUTLINE OF CHAPTERS

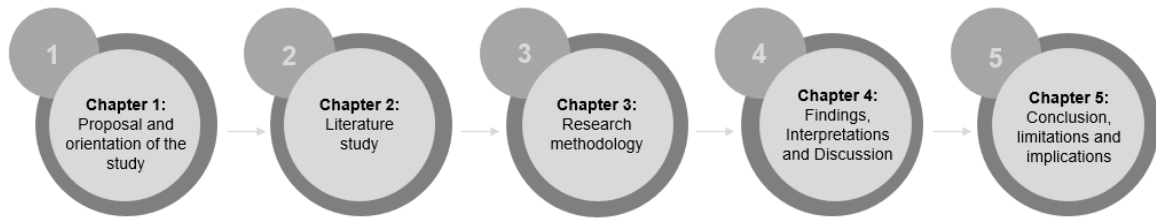


Figure 1: Filipe, E. 2020. Outline of research paper chapters (Filipe, 2020)

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The literature review is an important part of the research because it makes possible to familiarise ourselves with relevant academic sources regarding the topic, to understand how they can be applied, and look to previous works that have been done about the topic. The concept of biophilic design is discussed in terms of the theories and principles that are used for the application in the built environment. Subsequently, the design of a healthcare facility and the two emerging fields that walk alongside the healthcare facility, psychosocially supportive design and evidence-based design, and the interior design process is explored in terms of all the steps used by designers and architects. Lastly, the requirements used for the design of a healing environment. In figure 2, it is available in the literature selected that will help the study.

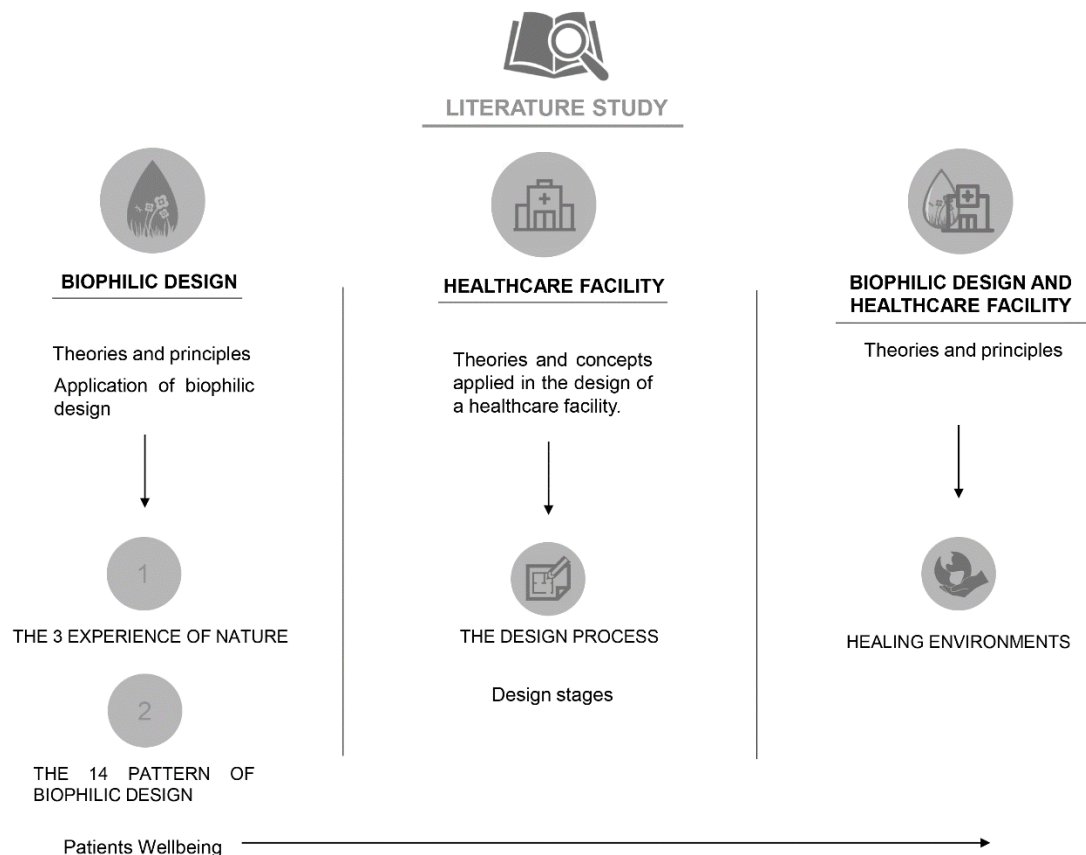


Figure 2: Filipe, E. 2020. Outline of the literature review. Diagram visualised by Filipe, E. (Filipe, 2020)

2.2 CONCEPTUALISATION

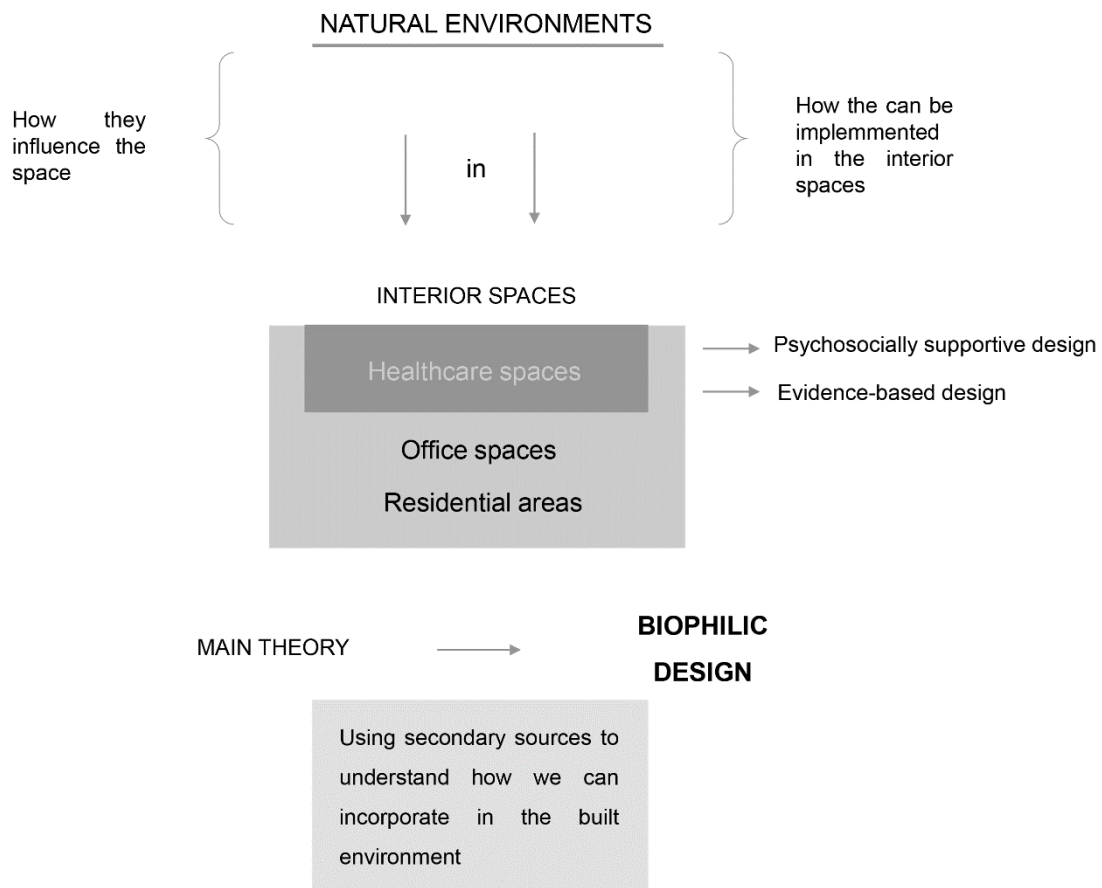


Figure 3: Filipe, E. 2020. Conceptualisation of key terms, diagram visualised by the author. (Filipe, 2020)

For this investigation, we will look at the application of the natural environment in the built environment, specifically in interior spaces, any space that will be used by people. The spaces that we will have a look are healthcare facilities, in order to understand the requirements and theories that are necessary for the application of the natural environment. The main theory is biophilic design, looking at the application.

In addition, the areas that we will look at, to help understand the application of biophilic design are the physical factors and elements of the built environment and healing environment. Physical factors of the built environment are part of the design process of a healing facility that influences the health and the wellbeing of the users (Salonen, Lahtinen, Lappalainen, Nevala, Knibbs, Morawska, and Reijula, 2013). Lastly, the healing environment focuses on creating spaces that help the patients and staff to cope and reduce stress (McCullough, 2010).

2.3 THEORETICAL FOUNDATION

The relevant theories relevant to research are biophilic design, psychosocially supportive design and evidence-based design.

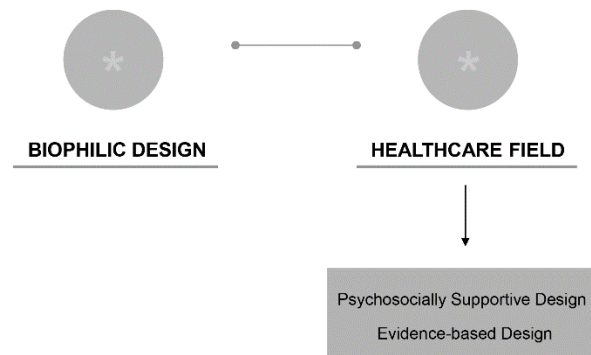


Figure 4: Filipe, E. 2020. The theoretical foundation of the study, diagram visualised by the author. (Filipe, 2020)

The researcher and professor of social ecology, Stephen Kellert, focused his attention on identifying the quality of biophilic design (Kyle, 2019). He defines as ‘‘the deliberate attempt to translate an understanding of the inherent human affinity to affiliate with natural systems and processes... into the built environment’’ (Kellert, 2008: 3). In the article, *The Practice of Biophilic Design*, Kellert and Calabrese (2015) highlight the fact that there have been many studies, which shows that exposure to nature in the healthcare facility can help reduce stress, lower blood pressure, provide relief and help in the healing process. We will also focus on the term biophilia, the natural system and processes (Kellert, 2008). Scientific researchers are showing that stress is reduced when people are exposed to natural, resulting in less time spending in the hospital, using less medication, specifically for pain (Davidson, 2013). With the biophilic design approach, it will be possible to understand better why the connection of human to nature is important specifically in healthcare design.

The following theories are connected to the design of a healthcare facility, focusing on the different areas of the healthcare field, the psychosocially supportive design, and the evidence-based design. The human and behavioural geographer, P. S. Ulrich focuses his research on stress reduction and the positive effect of having an outdoor space in a healthcare facility (Davidson, 2013). Ulrich studies focused on placing a healthy adult in a stressful situation after placing

them in different recovery space and see how they will react. He realised that when they were in a natural environment, there was a decrease in their heart rate, blood pressure, muscle tension and skin conduction (Davidson, 2013). Lastly, Ulrich researches focus on the mental and physical wellbeing of the patients and staff member of hospital influence the evidence-based design field (Kyle, 2019). It is a research area, developed by environmental psychologists, which influence the design of a healthcare facility (Kyle, 2019).

2.4 BIOPHILIA AND BIOPHILIC DESIGN

2.4.1 Biophilia

Kellert (2008: 3) define biophilia as ``the inherent human inclination to affiliate with natural system and processes, especially life and life-like features of the nonhuman environment´´. Biophilia is the need for the human to stay connected with nature (Ryan, Browning, Clancy, Andrews and Kallianpurkar, 2014). It is a very important aspect in nowadays because it influences the physical and mental health of people and well-being (Kellert and Calabrese, 2015). Biophilia is a hypothesis (Ryan, et al, 2014; Bringslimark, Bysheim and Nyrud, 2010; Gillis and Gatersleben, 2015) and a theory (Downton, Jones, Zeunert and Roös, 2017) which shows that the human connection to natural processes and systems is necessary to our health.

2.4.2 Biophilic Design

The concept of biophilic design comes from the hypothesis biophilia (Ryan, et al, 2014, Bringslimark, et al, 2010 and Gillis, et al, 2015), and It is defined as the effort to express the importance to incorporate in the built environment natural systems and processes, biophilia, to have a connection with human (Kellert, 2008). A design philosophy that encourages the built environment to use natural systems and processes during the design process (Gillis and Gatersleben, 2015). Providing a sustainable design strategy that helps people to reconnect with the natural environment (Downton, Jones, Zeunert, and Roös, 2017). In addition, it highlights the fact that it is necessary to use all benefits that natural environment brings in the built environment (Bringslimark, Bysheim and Nyrud, 2010).

The biophilic design gives the tool and helps to understand how we can incorporate the hypothesis ``biophilia´´ - natural systems and processes - in the built environment. They aim is to provide ways to help human to connect with nature while experiencing the built environment, in result; they improve our health, fitness and wellbeing (Kellert and Calabrese 2015). In figure 5, it shows an example of an existing space that applied biophilic design in their interior.

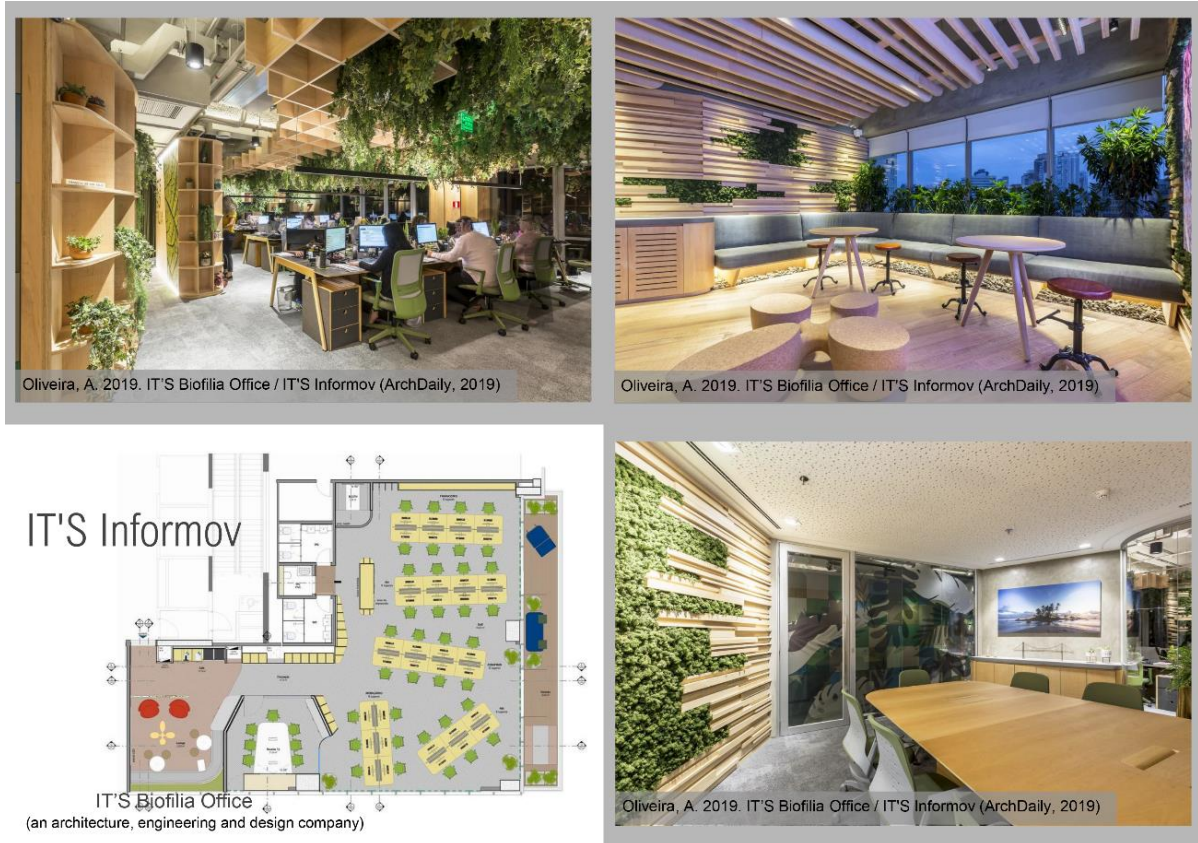


Figure 5: Filipe, E. 2020. IT'S Biofilia Office / IT'S Informov (ArchDaily, 2019), diagram visualised by the author. (Filipe, 2020)

2.4.3 The Application of Biophilic Design

There are different ways to apply biophilic design into the built environment. Kellert (2008) provides two basic dimensions that help designers and developers when they intend to apply biophilic design in their projects. The first dimension is an organic or naturalistic dimension, which focuses on the shapes and forms that highlight - directly, indirectly or symbolically- the connection between nature and human in the built environment (Kellert, 2008). The second dimension is the place-based or vernacular dimension, which focuses on the connection between

the building and landscape with the ecology of a locality or geographical area (Kellert, 2008).

The two dimensions are related to six elements of biophilic design, and they are the following: environmental features, natural shapes and forms, natural pattern and processes, light and space, place-based relationships and evolved human-nature relationships (Kellert, 2008). These six elements are revealed into 70 biophilic design attributes mentioned by Kellert (2008). In figure 6, it shows the elements and their respective attributes.

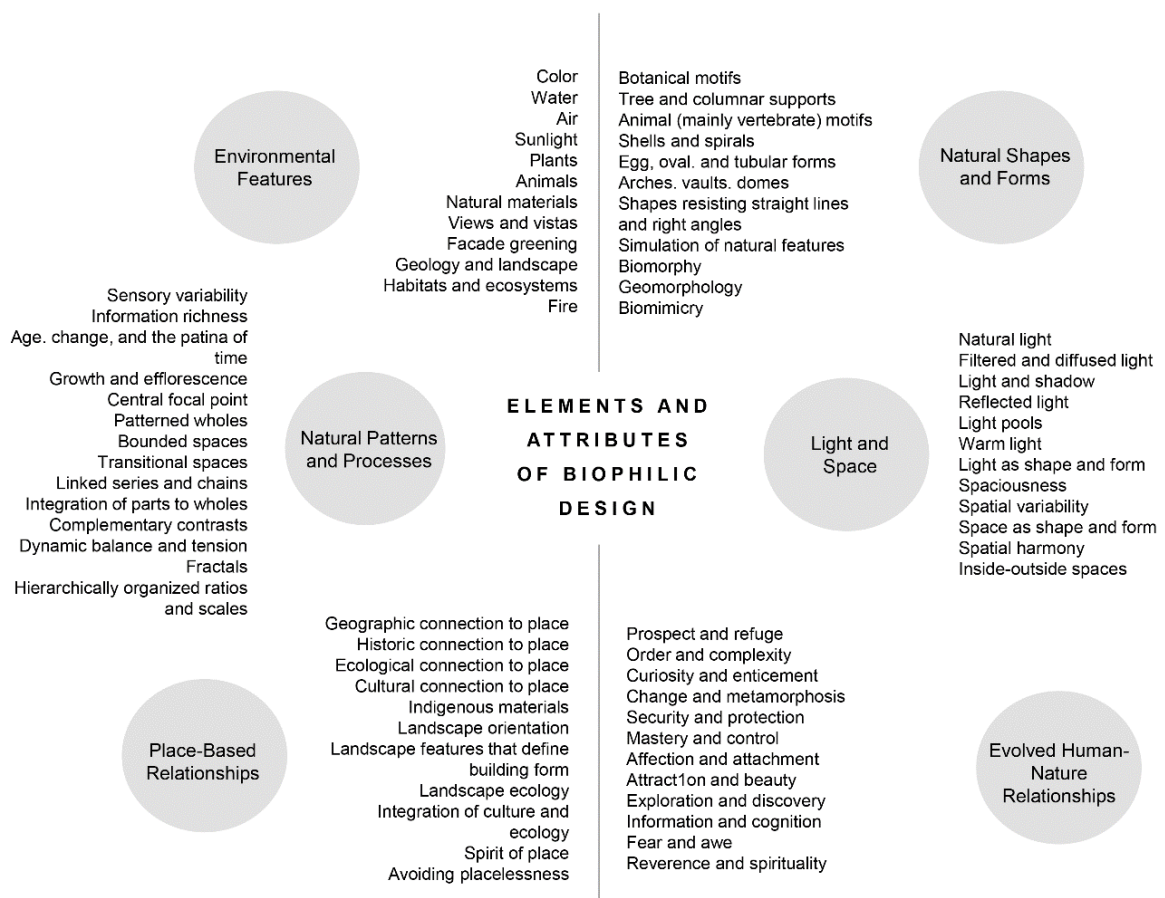


Figure 6: Filipe, E. 2020. The 6 elements of biophilic design and the related 70 attributes (Kellert, 2008), diagram visualised by the author. (Filipe, 2020)

2.4.3.1 The Experiences and Attributes of Biophilic Design

For the purpose of the study, we will focus on the three experience of nature and their specific attributes highlighted by Kellert and Calabrese (2015).

The first experience is the direct experience of nature, which focus on the real connection to natural environment features when we are in the built environment, such as natural light, air, plants, animals, water, landscapes. The second experience is the indirect experience of nature, which focus on the human connection to features representing nature, such as pictures, artwork and natural materials. The third is the experience of space and place, which focus on the spatial features of the natural environment that help human health and wellbeing in the built environment, such as prospect, refuge, organized complexity, mobility and wayfinding (Kellert and Calabrese, 2015). Subsequently, these three categories of experience are connected to 24 attributes (Kellert and Calabrese, 2015). In figure 7, it shows the three experiences of nature and their respective attributes.

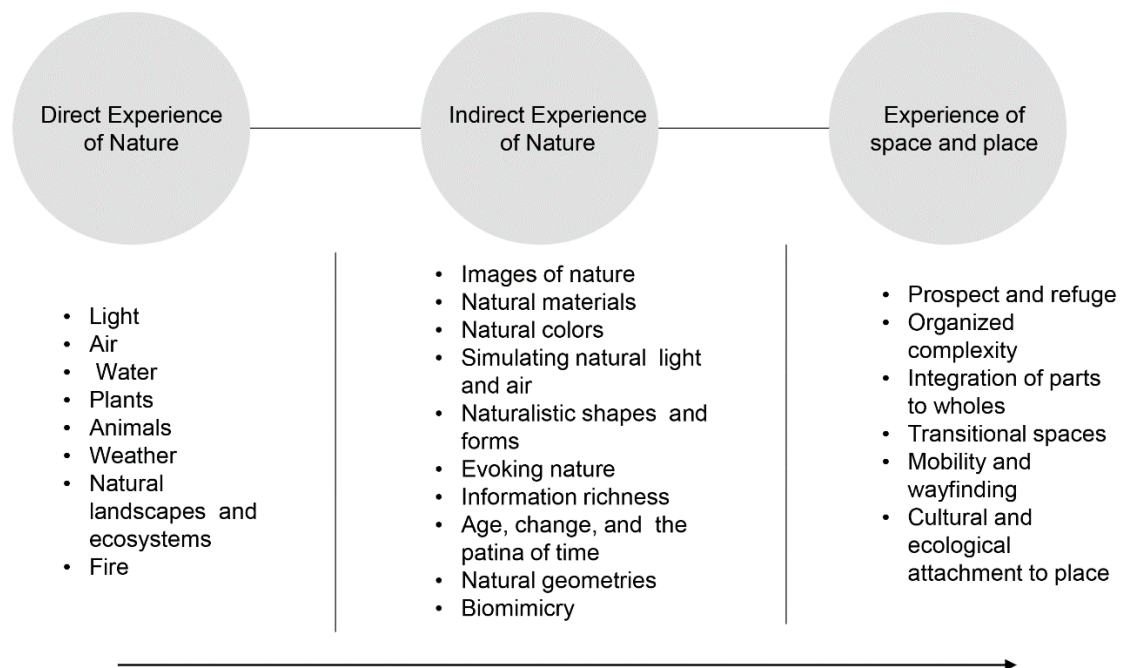


Figure 7: Filipe, E. 2020. The 3 experiences of Biophilic Design (Kellert and Calabrese, 2015), diagram visualised by the author. (Filipe, 2020)

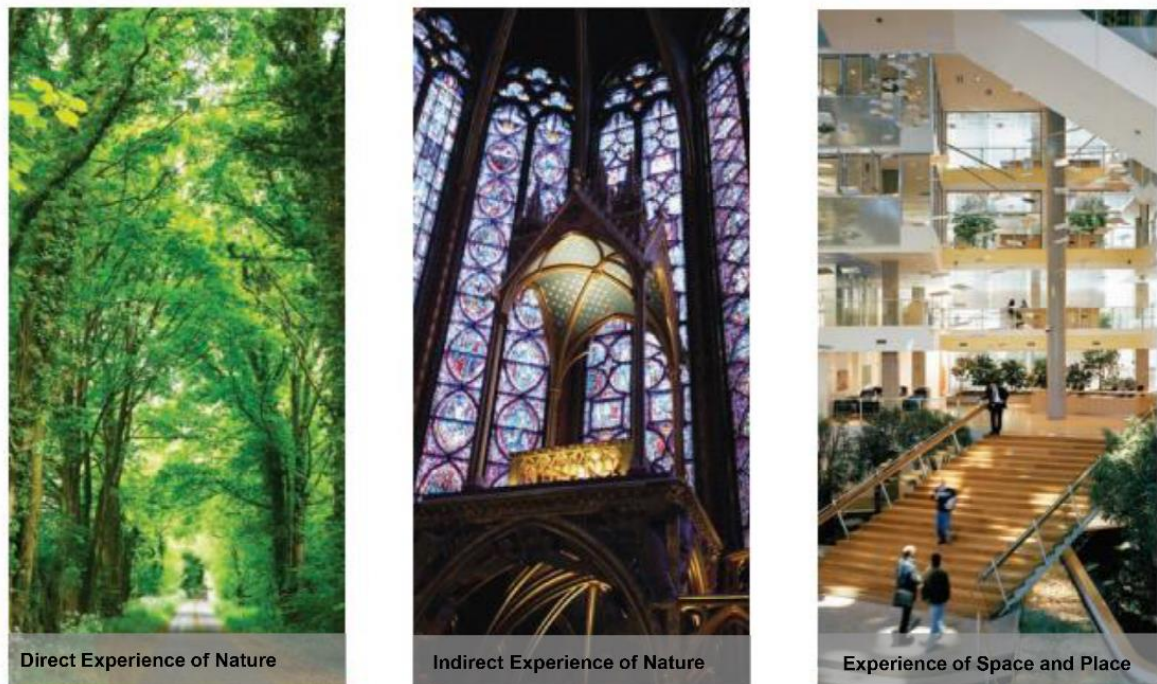


Figure 8: Kellert, S. R. and Calabrese, E. 2015. The experiences of nature. (Kellert and Calabrese, 2015)

2.4.3.2 The 14 Patterns of Biophilic Design

Downton, Jones, Zeunert and Roös (2017) highlight 14 patterns of the biophilic design proposed by W.D.Browning, C.O.Ryan, and J.O.Clancy (2014) called as the biophilic design ``toolkit''. They provide tools, design opportunities and different application that help to elevate the wellbeing and health of people.

The first category is the ``Nature in the Space'', it is the direct experience with the natural world with the people physical senses (KMB architects, 2019). It consists of the first seven patterns (Downton, Jones, Zeunert and Roös, 2017). The second category is the ``Natural Analogues'', it is the indirect evocation of nature (KMB architects, 2019). It consists of the eighth, ninth and tenth pattern (Downton, Jones, Zeunert and Roös, 2017). The third category is the ``Nature of the Space'', it is the spatial configurations that evoke a human response, which based on natural analogies (KMB architects, 2019). It consists of the last four patterns (Downton, Jones, Zeunert and Roös, 2017).

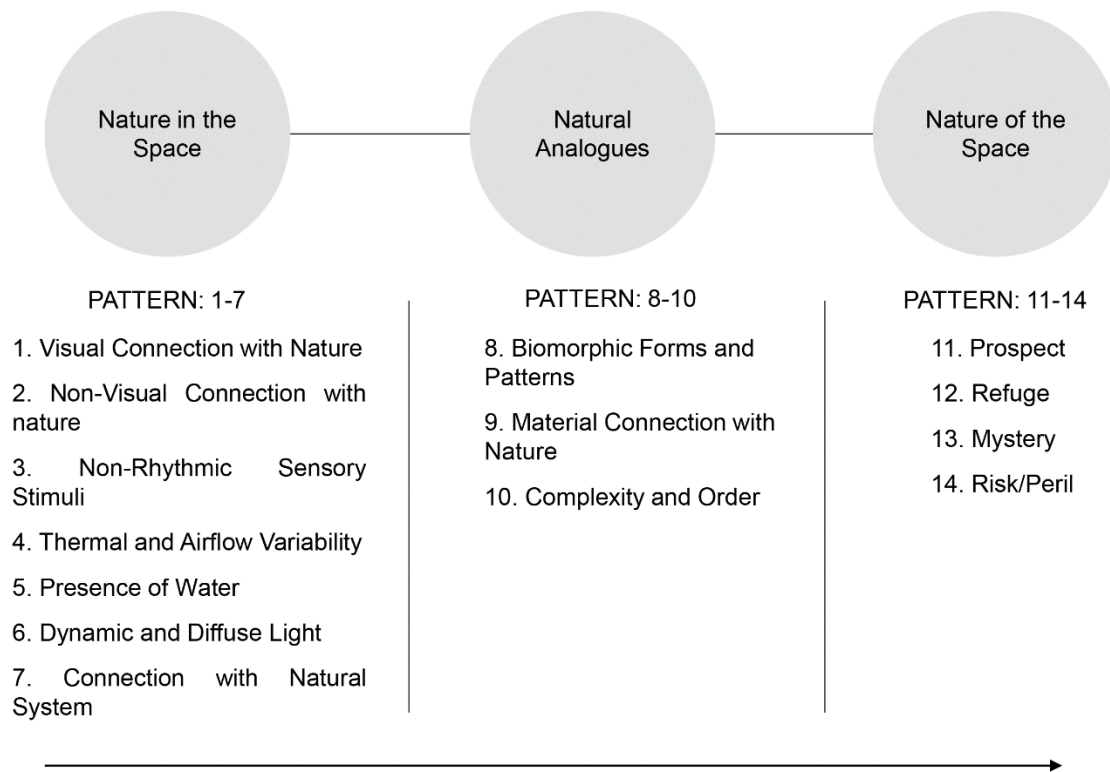


Figure 9: Filipe, E. 2020. The 14 patterns of Biophilic Design (Downton, Jones, Zeunert and Roös, 2017), diagram visualised by the author. (Filipe, 2020)

2.5 THE DESIGN PROCESS OF A HEALTHCARE FACILITY

2.5.1 The Design of a Healthcare Facility

The design of a healthcare facility focused traditionally on the creation of space that looked on their functionality, and provide good service (Ulrich, 1997; 2003). Space should provide enough space that accommodates the different type of equipment and a range of activity (Carpman and Grant, 2016). Dealing with vast and complex problems that need to be taken into consideration, such as medical, technical and social issues (Hicks, McGovern, Prior and Smith, 2015).

The design should not focus mainly on the functional efficiency, marketing, cost and codes of the facility, but also on promoting wellness, by providing a psychologically supportive space (Ulrich, 1997; 2003). Having a space that supports people can make the patients calm, and cope with stress during the healing process (Ulrich, 1997; 2003).

2.5.2 The Guiding Theories and Principles

There is two emerging fields associated with the design of a healthcare facility and they are the following: the psychosocially supportive design (PSD) and evidence-based design (EBD).

The psychosocially supportive design is a theory and a framework that promote health (Dilani, 2001). It helps healthcare designers and planners to understand how the physical environment of the healthcare facility can provide wellness in promoting health for both patient and the staff (Dilani, 2001). Focusing on promoting wellness, so that people can be able to cope with stress during the time, they spend in the hospital (Ulrich, 1997).

Evidence-based design is defined as the ``interactive decision-making process that begins with the analysis of current best evidence from an organization as well as from the field'' (Cama, 2009: 7). It connects with environmental psychology, architecture, medicine and other science (Zimring, Denham, Jacob, Cowan, Do, Hall, Kamerow, Kasali, and Steinberg, 2013). With the evidence-based design, it is possible to have access to materials from other fields to help with the design, with that we do not only follow the traditional architectural way (EVIDENCE SPACE, 2015). The basic principle is to focus on combining

streamlining processes, analyzing new technologies and create a design that can adapt over time to accommodate improved processes and new technologies (McCullough, 2010).

2.5.3 The Design Process of a Healthcare Facility

Salonen, Lahtinen, Lappalainen, Nevala, Knibbs, Morawska, and Reijula, (2013) highlight the physical factors that influence the health and the wellbeing of the occupants of a healthcare facility. Including space arrangement, materials, noise reduction, natural and artificial ventilation, the thermal of the environment, the views from the windows, natural and artificial lighting, the proper furniture focusing in the ergonomics, the wayfinding system and the appropriated music (Salonen, Lahtinen, Lappalainen, Nevala, Knibbs, Morawska, and Reijula, 2013).

The Royal Institute of British Architects (RIBA, 2013) developed eight design processes used in building design and construction, available in table 2 (Hicks, McGovern, Prior and Smith, 2015).

THE DESIGN PROCESS	SPECIFICATION
1.Strategic Definition	
2.Preparation	identifying the project objectives, the client's business case and other parameters or constraints required to develop an initial project brief.
3.Concept Design	the development of an outline specification and design proposals.
4.Developed Design	updated design proposals and specifications for planning approval submission.
5.Technical Design	produce a detailed design.
6.Specialist Design	performed by specialist subcontractors
7.Construction	
8.Use and Aftercare	

Table 2: The eight design processes developed by The Royal Institute of British Architects (Hicks, McGovern, Prior and Smith, 2015).

Subsequently, Carpman and Grant (2016) discuss the following stage that can take a long period to finish and are very complex. The stages focus on the different events and decisions in the moment of the project, available in figure 10 and 11.

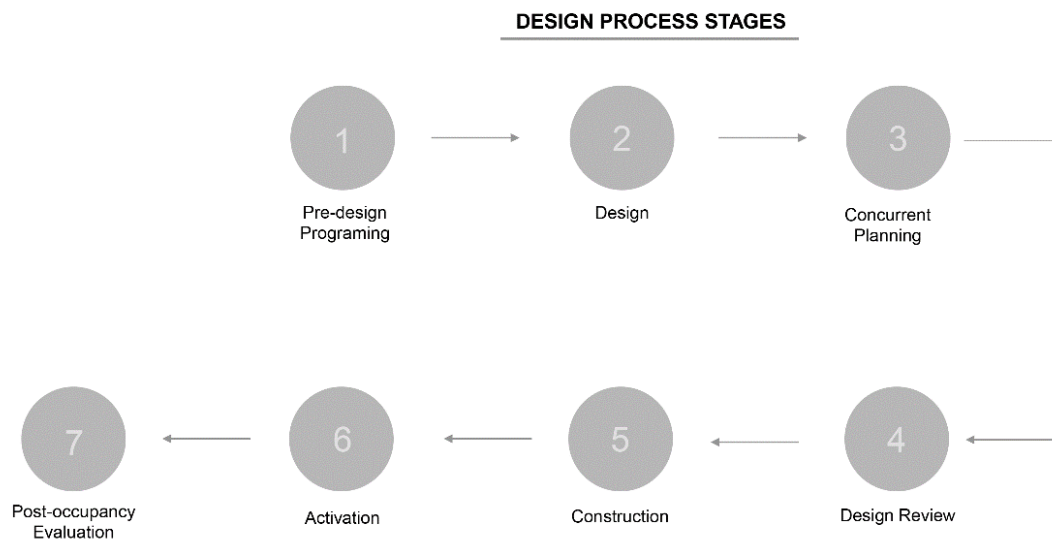


Figure 10: Filipe, E. 2020. Design process stage infographic Carpman and Grant, 2016) diagram visualised by the author. (Filipe, 2020

START

1.

PRE-DESIGN PROGRAMING

It is the stage that basic parameter of the project are set, such as the goals and the ojectives, the funtions, the size of the space, set intruction for the design team and design guideline. It is time to define the user's need, patients, nurses, family members and visitors and medical students.

3.

CONCURRENT PLANNING

Interior Design. The interior designer works closely with the architects and engineer. The basic services focus on space planning including layout of the rooms, aesthetics and functional goal, colour coordination, room finishes, furniture, furnishing and artwork selection.

Landscape design. The landscape designer look at the site planning and exterior design including vehicular and pedestrian circulation, parking, grading, drainage, exterior seating, selection of vegetation and the location of the exterior signs.

Wayfinding planning. Wayfinding look at the wayfinding issues, looking at the location of the signs in the interior of the facility. It does not only deal with signs but also with wayfiding elements.

Medical equipment planning. It is part of the design process, during the schematic design and design development and goes until the selection equipment. The identification of the mechanical and eletrical and can be pursued and installed.

2.

DESIGN

It has four design phases:

Block plan. Building entrance, vehicular traffic pattern, access points and internal staff and patient movement (flow of people) and the material.

Schematic design. It show the rooms and corridor space, mechanical, stairs, elevators and columns.

Design development. It is the time to refine the schematic design step, start with technical drawing. The room detail, door swings, light fixture, locations, counter and cupboards, medical equipment and furniture.

Construction documents. The architects and engineer start the construction documents, working drawing and specification, the quality of material and how they are built, the agreement between the client and the contractor and sign off.

4.

DESIGN REVIEW

At this stage, the client analyses the progress, floor, equipment, specification list, perspective drawings, digital simulation, mockups and technical specification.

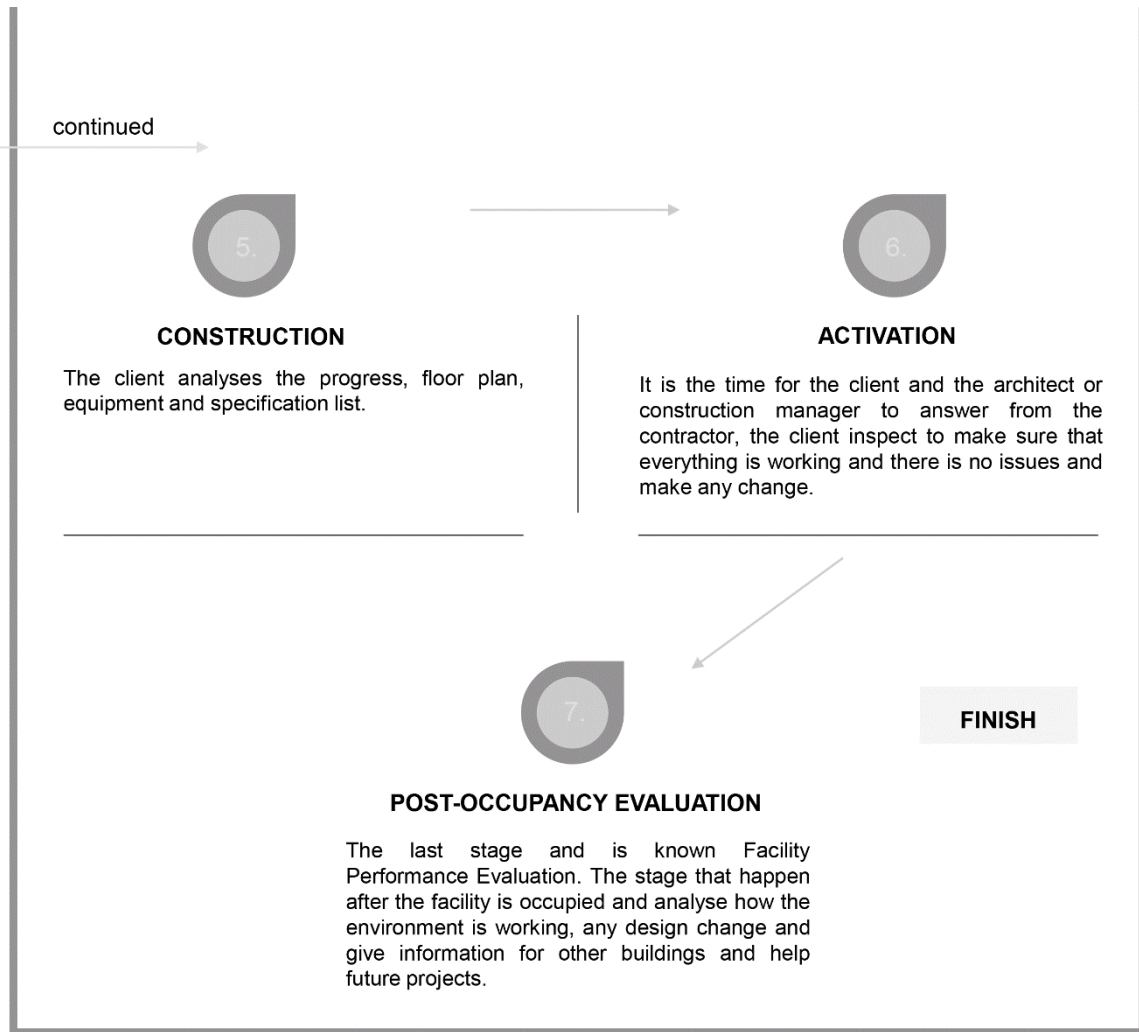


Figure 11: Filipe, E. 2020. The 7 stages of a design process (Carpman and Grant, 2016), diagram visualised by the author. (Filipe, 2020)

2.6 BIOPHILIC DESIGN AND HEALTHCARE FACILITY

2.6.1 Biophilic Design in Healthcare Facility

The size and complexity of the hospitals make function as an island, not having access to green spaces, and end up being surrounded by urban area (Jiang and Verderber, 2015). Patients feel confined, isolated and deprived of the outside world, calling for their biophilia, their need to connect to nature increases (Kyle, 2019). Access to green areas causes therapeutic sense, which can provide fast recovering and a better experience for the patients (Jiang and Verderber, 2015). Reflecting on the application of the principles of biophilic design in the healthcare facility is becoming a very interesting area (Totaforti, 2018).

It is important to make the design of a hospital from the point of view of the patient, thinking not only on the physical but also at the social and psychological needs (Totaforti, 2018). Humanising the spaces by reconnecting the occupant with nature, offering therapeutic support that will influence the psychological and physical wellbeing (Totaforti, 2018).

Therapeutic design is the design of outdoor and indoor spaces that aim to have biophilic environmental design principles in mind, and highlighting the fact that we need sequenced spaces in the hospital (Jiang and Verderber, 2015). Nature is an important aspect of healthcare facilities outdoor space, for the health and well-being of the patients and staff members (Davidson, 2013).

2.6.2 The Healing Environment

Ghazali and Abbas (2017:78) define healing environment as ‘‘the overall environment, both physical and non-physical, created to aid the recovery process’’. It is the place where the people are respected, and their dignity is everything, getting their body, mind and soul healed (McCullough, 2010). It is either physical or non-physical that help the patient during the recovering process (Abbas and Ghazali, 2010). A healing environment is known to protect the user, making the facility less risky and stressful, providing greater healing and proper space for the staff to work (McCullough, 2010). In figure 12, is an example of a healing space that aim in the recovery of patients with cancer.



The Maggie's Leeds Centre

A healthcare center designed by the Heatherwick Studio that provide free practical and emotional support for people with cancer, located at the St. James's University Hospital in Leeds. They followed their philosophy and the belief that great design helps making people feeling better. The used prefabricated and sustainably sourced spruce timber system for the structure and lime plaster, a porous material, which help with the internal humidity of the space. Using "healthy" materials and materials that save energy. It helps with the ventilated building, which was taking in consideration the form and orientation. There is a rooftop garden, designed by Balston Agius, ward-winning landscape designer, where visitors are encouraged to participate on the care of the space, the 23000 bulbs and 17000 plants. They explore what normally is missing in healing environments, incorporating natural and tactile materials, soft lighting, and a variety of spaces that encourage social opportunities and quiet contemplation. They want the interior to give the patients a sense of home, by filling the window sills and shelves with personal objects.

Figure 12: Filipe, E. The Maggie's Leeds Centre. The St. James's University Hospital in Leeds (ArchDaily, 2020). Diagram visualised by the author (Filipe, 2020)

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

In the following chapter, the design of the research is discussed in terms of the population, the sample selection, data collection methods, the tool used to collect the data, data analysis methods and the tool used to analyse the data. Making sure that we meet the aims and objectives of the study, and answer the research questions. The objective of the study is to explore the design process that focuses on the intrusion of biophilic design, used by interior designers and architects, in the design of a healthcare facility.

3.2 DESIGN OF THE STUDY

3.2.1 Research Design and Paradigm

This study follows the qualitative research design. This research has the objective to “understand, explore or to describe people’s behaviour”, showing how people act toward others and in an interior space (Davis, 2014:14). The aim is to describe and clarify the events experienced by human using written and spoken word, rather than using language in the form of numbers (Polkinghorne, 2005). There are two goals available in this research. The first goal is the practical goal, focusing on the goal that the study needs to accomplish, specifically to understand the process used by interior designers and architects to we can apply biophilic design in a healthcare facility. On the other hand, the intellectual goal focuses on understanding the theories of biophilic design, specifically how it works in the built environment (Maxwell, 2005. Cited in: Cohen, Manion and Morrison, 2018).

Incorporating the epistemology perspective of interpretivism, which highlights the fact that individuals and society are not possible to be separated, they all work together and one completes another (O'Donoghue, 2007). The meaning of the word is very important and it uses qualitative methods to perform the research, such as case studies, interviews, and observation, so that they have a better understanding of how people interpret the world (Willis, Jost and Nilakanta, 2007).

In addition, an inductive approach will be incorporated, focusing on finding the pattern that it will generate theories and the concepts, in which will come during the data collection process (Business Research Methodology. s.a). Subsequently, it is possible to find existing theories that fit the study during the data collection (UKEssays, 2017). Focusing on defining generalised theories that come from someone's experience (Auriacombe, 2016). The study will use secondary research, to provide information for the chosen case studies and unobtrusive research. In secondary research, the data is available online, in academic databases, the news, published books, and journals (McCrocklin, 2018). The objective will be to explore and explain the content of a physical artefact, specifically hospital spaces (Cohen, Manion and Morrison, 2018). Lastly, the cross-sectional study will be conducted, to allow the research to compare different variables in the two cases (Institute for Work & Health, 2015). Here, it will be presented the differences and the similarities of the two case studies.

In figure 8, it is available the research design stages used in the study. The study used the research onion that was developed by Saunders et al. (2007), which highlights the step followed by the researcher (UKEssays, 2017).

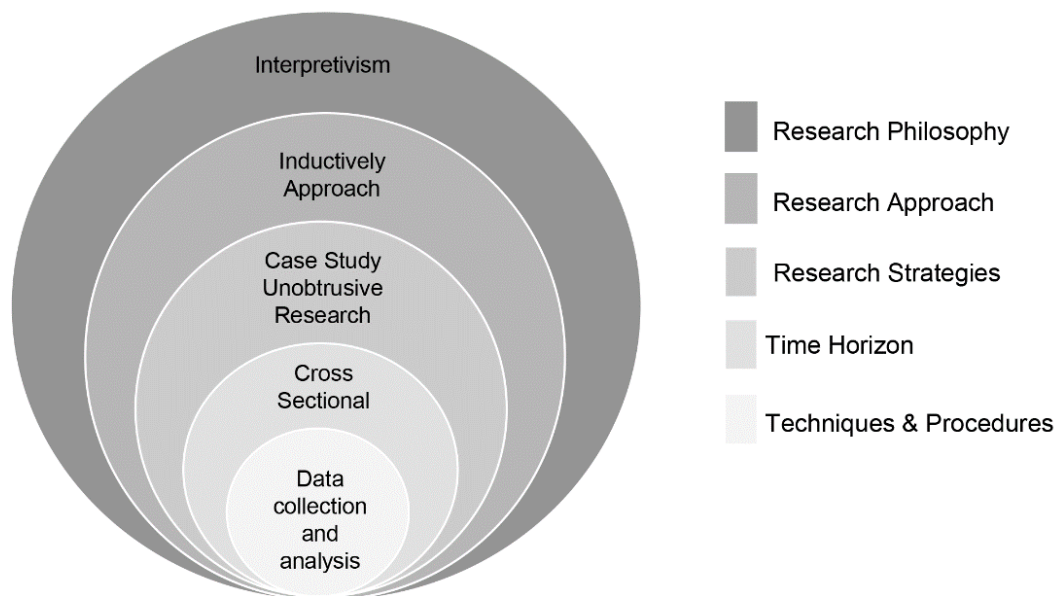


Figure 13: Filipe, E.2020. Research Design (Filipe, 2020)

3.3 SAMPLE SELECTION

The population of a study is defined as ``the total group of people or entities - social artefacts - from whom information is required`` (Wiid & Diggines, 2013, pp.186. Cited in: Plooy-Cilliers, Davis & Bezuidenhout, 2014, pp. 132). Not only the number of people but also the things or cases that are subjective to a study (Etikan, Musa and Alkassim, 2016). Focusing on the research question and the research problem, to identify the population of the research (Pascoe, 2014). In the study, the population focus on hospitals that applied the concept of biophilic design in their design process.

Subsequently, the sample is a part of a population or universe (Etikan, Musa and Alkassim, 2016). Using the purpose of the study and the research approach, it is possible to determine the size of the sample (Pascoe, 2014). Using information that is available online, in academic databases, the news, published books, and journals, to answer the research questions (McCrocklin, 2018). The scope of the sample incorporates two architectural case studies that will consist of images, photographs, drawings, and information, using secondary research to collect the data. The two selected cases are from different locations, international and local hospital projects, coming from the interior design and architecture industry, to identify the current methods and concepts used by the different locations.

The participants of the study are selected using a purposive sampling technique. Pascoe (2014, pp. 142-143) mentions that it is a non-probability sampling where ``we purposefully choose the elements that we wish to include in our sample, based on a set of list of characteristics``. Purposive sampling is known as a judgment sampling and uses a non-random technique, where the researcher determines the participant of the sample that meets all the qualities needed in the study (Etikan, Musa and Alkassim, 2016). The researcher chooses the people that provide the information, having all the knowledge and experience. The reason for selecting this sampling is that the study will look specifically at cases with a specific characteristic that will be very helpful during the data collection. As it was mentioned, the study will use a cross-section approach so that it is possible to compare the two cases, to find the differences and how they complement each other.

The first case will focus on international hospitals, such as the Khoo Teck Puat Hospital in Yishun, Singapore, the Newport Health Center in Washington, the United State of America, and the Royal Children’s Hospital in Melbourne, Australia. On the other hand, the second case will focus on South African hospitals, such as the Chatsworth Youth Centre in Durban, the Pietermaritzburg Assessment and Therapy Centre in Kwazulu Natal, and Umkhumbane Community Health Centre in Durban.

Having the characteristics, the objective, and research questions in mind, the study will purposely use the hospital in Singapore, called Khoo Teck Puat for the international case. In addition, for the national, the study will use the Umkhumbane Community Health Centre in Durban. The reason for selecting these two healthcare facilities is that they both meet the characteristics needed for the study. They will help us understand how they treat their hospitals regarding the application of biophilic design in their specific location.

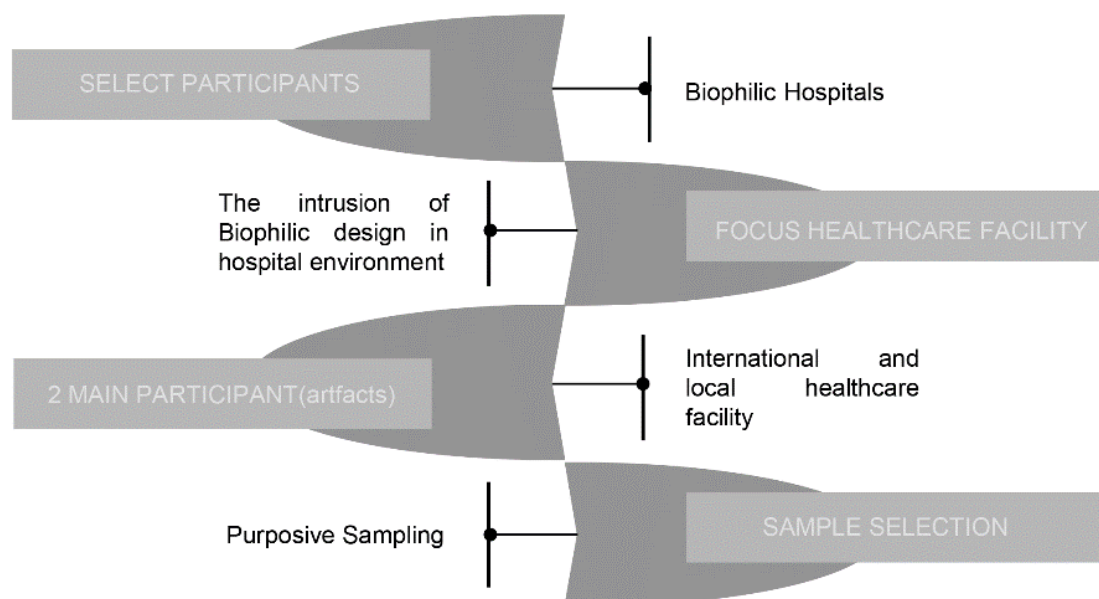


Figure 14: Filipe, E. 2020. Population Sample Diagram (Filipe, 2020)

3.4 DATA COLLECTION

3.4.1 Data Collection Tool

The data collection method used in the study is the case study approach and unobtrusive research. With the data collection methods, it is possible to gather enough information about the Khoo Teck Puat Hospital in Singapore, and the Umkhumbane Community Health Centre in Durban, so that later can be analysed. Using secondary sources, available on the internet, to collect the information and the corresponded photography and drawings, coming from academically credible internet sources and they will be properly referenced. Making sure that all the information is correct, accurate, and reliable, taking all the precautions to find correct information, the cases will have a minimum of five credible sources.

In the case study research, the researcher focus in a phenomenon or event that exists in the word and implement in the study, to understand how the participant experience a particular situation (Strydom and Bezuidenhout, 2014). The study will use the exploratory case study, explanatory case study, and the embedded multiple-case design as the tool to collect the data collection.

The exploratory case study describes the case so that we understand its nature (Strydom and Bezuidenhout, 2014). The explanatory case study explains the different circumstance of a phenomenon (Strydom and Bezuidenhout, 2014), focusing on testing different theories (Cohen, Manion and Morrison, 2018). The embedded multiple-case designs happen when sub-units are involved in the different cases, and it used different type instruments such as survey, questionnaire, interviews, observations, archival records and more (Cohen, Manion and Morrison, 2018). Proving a deep description of the two hospitals, to understand their design process and the different theories that they use.

The unobtrusive research is as non-reactive, it is the study where there is no involvement between the researcher and the participants, but it does not affect the findings of the study (Strydom and Bezuidenhout, 2014). Using traces, documentary records, and direct non-participative observation as the main source to collect data (Lee, 2019). The tool used will be qualitative content analysis and conceptual analysis as the tool to collect the data.

The qualitative content analysis is the method that the researcher uses a subjective interpretation of data by classifying the processes and identification of themes and patterns (Hsieh and Shannon, 2005. Cited in: Strydom and Bezuidenhout, 2014). It works effectively when the data come from journals, diaries, books, brochures, written documents, transcripts, news reports, and visual media (Maree, 2007. Cited in: Strydom and Bezuidenhout, 2014). Using themes and patterns to find the data, materials that focus on hospitals that used biophilic design.

The conceptual analysis is all the concepts, expectations, assumptions, theories, and beliefs used information, to explain and understand the event or phenomenon that we are facing (Maxwell, 2005. Cited in: Auriacombe, 2016). It is used to develop typologies, models, and theories, using a bottom-up approach (Auriacombe and Meyer, 2020). Looking for the concepts, theories, and beliefs used in the hospitals, to be part of their description. The study will use articles, dissertations, and known design websites to find the data.

3.4.2 Method of Collection

The internet was consulted and scanned looking for architectural projects that meet the requirements described in the sample selection. Having the problem statement and research question in mind when selecting then. The study provides insight into the projects, focusing on the theoretical framework and concept, on how they manage to solve the problem and show their contribution. The study will use reliable and well-known design websites, architecture dissertations, and articles to collect the data, consisting of information, drawings, and photographs.

In the *first step*, the internet was scanned for overseas architectural projects, located in any part of the world. Numerous projects are available online that could have been picked up, but we focus on three projects to have a look and be the prospective finalist for the data collection. In the *second step*, the internet was scanned for architectural projects that are located locally, in South Africa. This step was a little bit challenge because it was difficult to find hospitals that focus specifically on biophilic design. However, it was finally possible to find three projects that applied the biophilic design in their conceptual approach. In the *third*

step, we focus on reading two to three sources of the six hospitals, to understand if they meet the specific characteristics of the sample.

In the *fourth step*, the two cases were selected, the ones that meet specifically the characteristics of the sample, and making sure that they meet the objective of the study. The international case is the hospital called Khoo Teck Puat from Yishun in Singapore. On the other hand, the South African case is the Umkhumbane Community Health Centre in Durban. The reason to select only two cases is that it will be possible to go in-depth in both cases. In the *fifth step*, having the two cases selected, it was time to collect more data for other databases that are available on the internet. The study includes triangulation, in order to do peer examinee of the findings, respondent validation, and reflexivity to check data. In the *sixth step*, the data is collected, including the information, photographs, and drawings, and stored in two different documents in a secured computer that will be analysed at a later stage.

3.5 DATA ANALYSIS

3.5.1 Data Analysis Tool

All the raw collected data is secured in the computer and now is time for the analysis and interpretation to begin, using qualitative data analysis. Qualitative data analysis has the role to reduce, organise, interpret, and substantiate the data (Bezuidenhout and Cronje, 2014). Focusing specifically on the content or textual analysis, visual data analysis and coding, to analyse the data.

Content or textual analysis is a method used in qualitative research to collect textual content, available in words, images, pictures, sculptures, paintings, documents movies, and videos, in order to understand exactly their meaning (Bezuidenhout and Cronje, 2014). Using this type of data analyses, it helps to understand the content of the information, photographs and drawing of the two biophilic hospitals.

Visual data analysis is a method that analyses images of interior spaces and understands the concept that the designer used. In Architecture, we can use the following guideline when analysing an image: materials and construction, the composition of the plan, style, site, temporal element, proportions, facade, interior, function, and alterations (SKIDMORE, s.a). The study will focus

specifically on the materials and construction, interior, and function guidelines, during the visual analysis. The visual analysis method allows the data to become richer allowing discovering of additional information about the case giving validity and depth, at the same time creates knowledge (Glaw, Inder, Kable, and Hazelton, 2017).

With all the data, the study will use coding to facilitate analysing and reporting the data. Coding focuses on giving a name or label to a text that has specific information (Cohen, Manion and Morrison, 2018). For this study, the coding that it will be used is selective coding, which consists of selecting core categories that on the text to form a theory (Cohen, Manion and Morrison, 2018). Providing colour coding, for the visual analysis, showing the elements that represent the concept of biophilic design.

3.5.2 Method of Analysis

All the data collected, such as information; drawings, and photography, that are secured in a document is analysed using the qualitative analysis process. It focuses on choosing an appropriate sample of data breaking down the text into smaller component units of analysis, developing appropriate categories or conceptual framework for analysing the data (Cohen, Manion and Morrison, 2018). Later, a summary with all the relevant information is made, including in coding the units to fit the categories, conduct frequency counts of the occurrence of the units, analysing the text from the basis of the unit and how they relate to other units in the text (Cohen, Manion and Morrison, 2018).

In the *first step*, a description of the two case studies from the raw data will be made, to have a deep understanding of the two hospitals. Focusing on the architects behind the project, the conceptual approach applied, and how they consider biophilic design in the design. In the *second step*, the case will be analysed according to the theoretical framework discussed in the literature review, such principles, attributes, experiences and pattern of biophilic design, as well as the theories that came during the collection of the data.

In the *third step*, it is time for the visual analysis, looking at the photographs and drawings, focusing on observing images and videos of interior of hospital projects that incorporate the natural environment in the interior. In the *fourth step*, we will

colour code the element that represents the biophilic design in the photographs and drawings. In the *fifth step*, it is time to organise the findings, using the “2D Matrix” system. Having the principles, attributes, experiences on one side, and colour coding on the other side. In the *sixth step*, cross-case analysis will be conducted, focusing on the different ways that both hospitals used biophilic design. In addition, we will draw conclusions from the coded data, interpret the data, and report the methods and findings.

The following figure 10, a diagram is summarised, showing the planned design of this study, in terms of the data collection tools and data analysis.

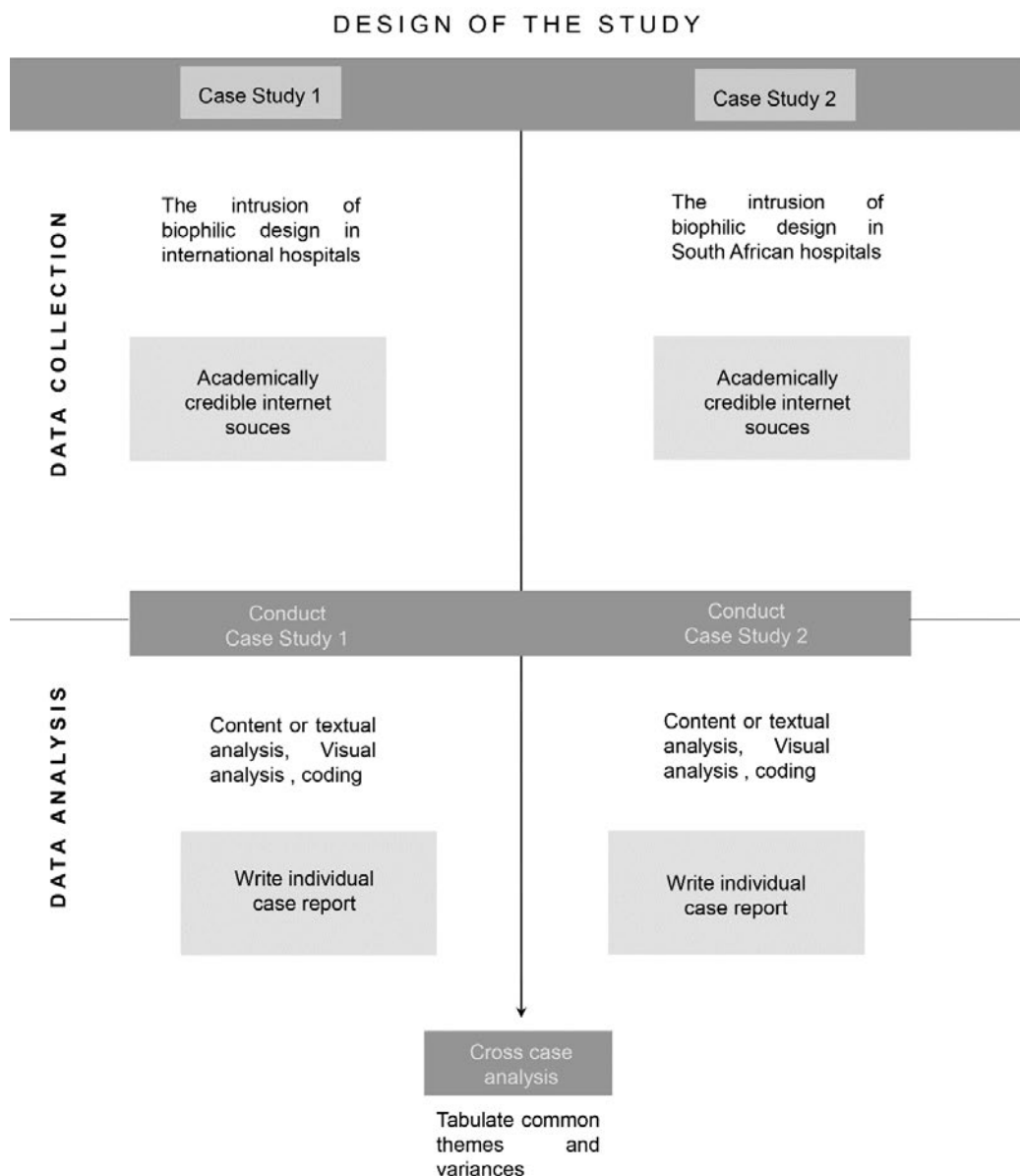


Figure 15: Filipe, E. 2020. Design of the Study (Filipe, 2020)

3.6 CHAPTER SUMMARY

Overall, the design of this study has been discussed in terms of the research design and paradigm, the sample selection, data collection tools, and methods, and data analysis tools and analysis. Making sure that the methodology choices for the data collection and data analysis meet the aims, objectives, and answer the research question. The research will explore and explain two architectural case studies, specifically the Khoo Teck Puat Hospital in Singapore and the Umkhumbane Community Health Centre in Durban, South Africa. To conduct content and visual analysis of the collected data and present the finding. In the end, it will be available a cross-sectional analyse highlighting the different methods made by the two cases.

CHAPTER 4: FINDINGS, INTERPRETATIONS AND DISCUSSION

4.1 INTRODUCTION

In the following chapter, the research discussed earlier is performed providing the interpretations and discussions of the findings, coming from the data collected from the secondary sources. We focus on the completion of two cases studies. The first case is the Khoo Teck Puat Hospital, and the second case is the Umkhumbane Community Health Centre, coming from the content and visual analysis from the secondary sources. These case studies are analysed according to the literature review and theoretical framework.

First, a description of the case is provided, information coming from the content analysis. Visual analysis is performed on the two case study. The data is interpreted and discussed according to the design intervention used to implement biophilic design elements and attributes into space. The design intervention is the three experiences of biophilic design and the 14 patterns of biophilic design, which is broken down into three categories, nature in space, natural analogue and nature of space. Lastly, a cross-section analysis is conducted focusing on their similarities and differences between the two cases.

In addition, the visual analysis is conducted using codes and colours system, to recognise the biophilic elements used in both hospitals. The design intervention that used is the analysis are the three experiences of biophilic design and the 14 patterns of biophilic design categories. Table 3 shows the codes and colours used for the visual analysis performed in both cases.

EXPERIENCES OF BIOPHILIC DESIGN	CODE	COLOUR	PATTERNS OF BIOPHILIC DESIGN	CODE	COLOUR
Direct experience of nature	BD1DN		Nature in a Space	PBD1	
Indirect experience of nature	BD2IN		Natural Analogue	PBD2	
Experience of space and place	BD3SP		Nature of a Space	PBD3	

Table 3: Visual Analysis codes and colours system (Filipe, 2020)

The visual analysis is divided into three areas, the technical drawing analysis, exterior areas analysis and interior areas analysis.

4.2 PRESENTATION AND DISCUSSION OF FINDINGS

4.2.1 Khoo Teck Puat Hospital

Architects: RMJM and CPG Consultants (Pty. Ltd., Executive Architect)

Location: 90 Yishun Central, Singapore

Client: Alexandra Health Services

Completion date: June 2010

Total floor area: 108,000 m²

Sector: Healthcare

Project Value: R 6 087 390 485, 00

4.2.1.1. Justification of the Case Study

The Khoo Teck Puat Hospital is a health facility situated in Singapore, which received the first annual Stephen R. Kellert Biophilic Design Award in 2017 (Trimtab, 2017). The facility achieved this award because the hospital integrates nature to, firstly, to help the patient relieve their pain, and be able to improve their recovery time by staying in the natural environment that focus in their healing

process. Secondly, give the hospital a park-like environment for the public and the staff members. Thirdly, increase the view and access to nature, to work productively (International living future institute, s.a).

The architects used the concept of “hospital in a garden, garden in a hospital”, which set a new benchmark in healthcare design (CPG consultants, 2020; Reddy, 2017; Lit, 2012). In addition, the Ex-CEO asked that the facility would be designed in a way that “one’s blood pressure lowers when he/she enters the hospital ground” (International living future institute, s.a). The facility is the first green hospital that has energy-efficient reduction costs of 50%, provides natural ventilation on 70% of the floor area, and the energy efficiency comes to 27% from the daylighting, air and temperature control and heat recovery to reduce their carbon footprint, focusing on the patients and staff members comfort (Blom, 2013).

4.2.1.2 Visual Analysis

The visual analysis is divided into three areas. The technical drawing analysis, exterior areas analysis and interior areas analysis with private and public spaces.

1. Technical Drawing

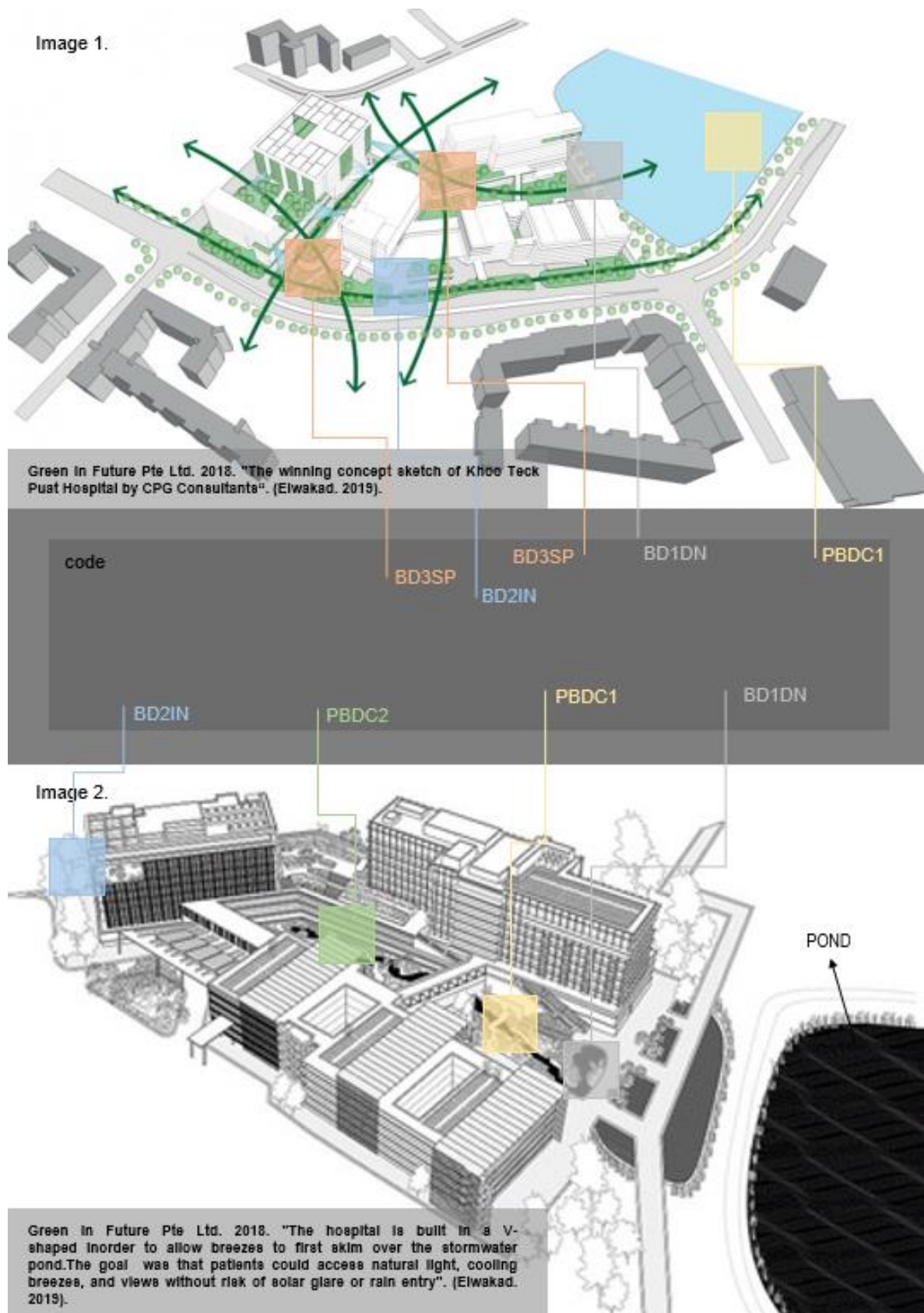


Figure 16: Filipe, E. 2020. Khoo Teck Puat Hospital Technical Drawings, diagram visualised by the author. (Filipe, 2020)

2. Exterior Spaces



Figure 17: Filipe, E. 2020. Khoo Teck Puat Hospital Exterior Spaces, diagram visualised by the author. (Filipe, 2020)

3. Interior Spaces

- Interior Spaces - public areas

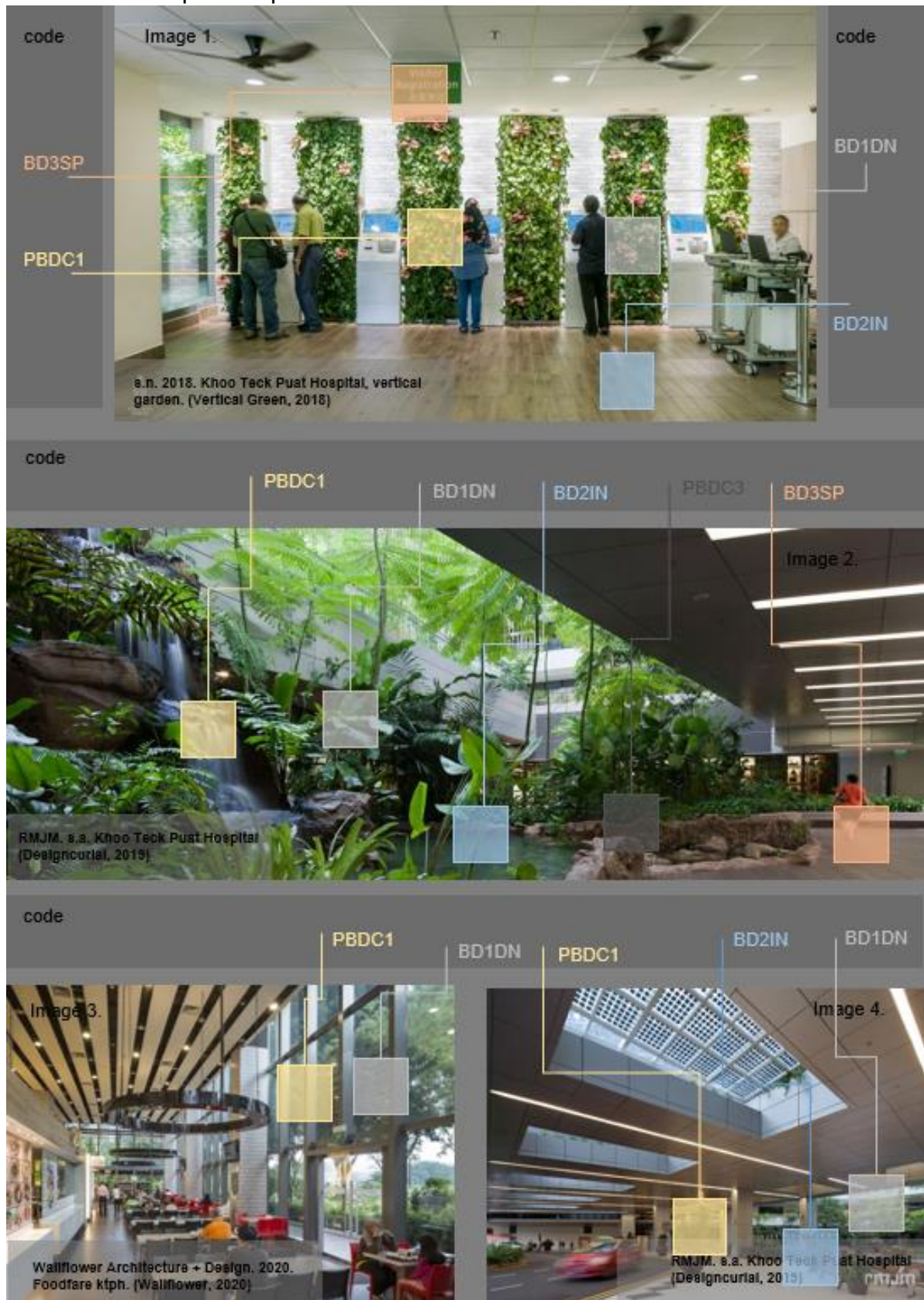


Figure 18: Filipe, E. 2020. Khoo Teck Puat Hospital Interior Spaces, public areas, diagram visualised by the author. (Filipe, 2020)

- Interior Spaces - private areas

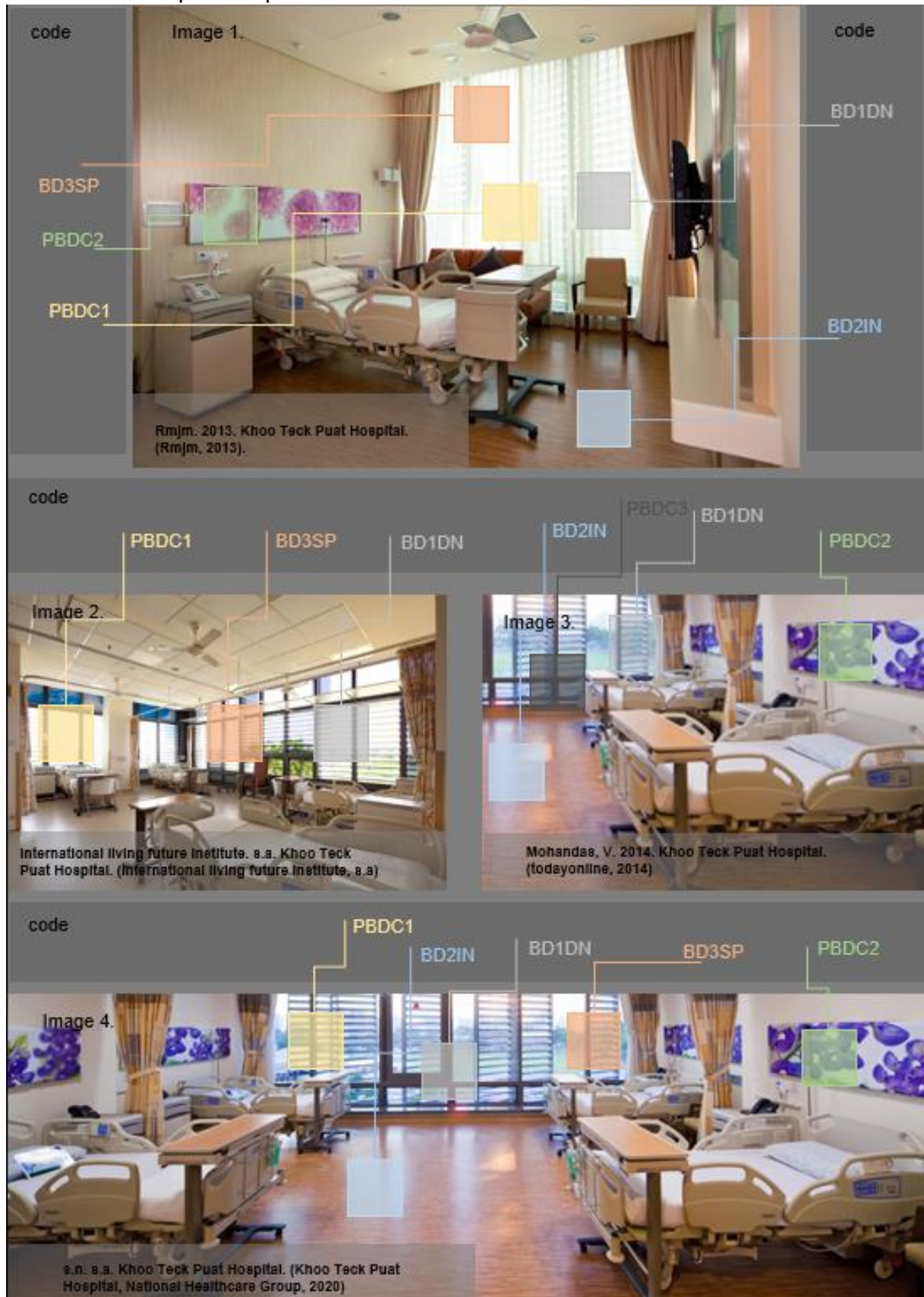


Figure 19: Filipe, E. 2020. Khoo Teck Puat Hospital Interior Spaces, private areas, diagram visualised by the author. (Filipe, 2020)

4.2.1.3 Discussion of Findings

4.2.1.3.1 The Three Experiences of Biophilic Design

1. The direct experience of nature

As mentioned in the literature review, the direct experience of nature is the actual contact to the natural features when using the built environment (Kellert and Calabrese, 2015). The attributes used for this experience are light, air, water, plants, weather, and natural landscapes and ecosystems.

In figure 16, it is available the site layout and shows that the architects RMJM and CPG Consultants consider the use of water and plants, during the conceptualization phase. The drawings show that the site presents enough vegetation, for the user to have direct contact with plants, natural ventilation, daylight and water when circulating the building (image 1). The shape of the building took into account the condition of the site so that it takes the airflow coming from the existing pond, having natural ventilation throughout the building. The architects managed to make a connection between water and plant in the site so that the user can have direct contact with both (figure 16), highlighting the experiences weather, and natural landscapes and ecosystems. In addition, they considered this experience in the early design stage, making sure that all the users of the building can have contact with nature both in interior and exterior spaces.

In figure 17, it is available the exterior spaces of the hospitals, providing seating area, walking area and transitional spaces to have access to a different part of the building. The seating area is all open allowing for natural ventilation and nothing blocking daylight, allowing for natural light and ventilation. The plants are covering all the seating area (image 3), and a roof garden was integrated to incorporate vegetation, (image 2). Showing that the architects considered the elements of the natural environment as the central idea for the exterior spaces.

In figure 18, it is available four areas of the interior of the hospitals, specifically public areas. The architects designed a vertical garden in the registration area, and the window provides a view to the outside and natural light (image 1). It was not only introduced light, water, plants, but also natural landscapes and ecosystems, where plants, animals, water, soils, rocks, and geological forms, is

placed all in the same area (Image 2). There are windows for ceiling to floor in the eating area and registration area, making it possible to have a view of the natural elements from the outside (image 3 and 1), and the skylight was implemented in the ceiling for natural light and air (Image 4). RMJM and CPG Consultants used design intervention such as vertical garden, windows from ceiling to floor and skylight to allow for direct connection to nature.

Lastly, in figure 19, it is available for the interior of the patient's rooms. Placing windows in all the rooms that go from ceiling to floor, to allow for daylight, ventilation and a view to the outside.

2. The indirect experience of nature

The indirect experience of nature is the contact with characteristics that represent the natural environment (Kellert and Calabrese, 2015). The attributes used for this experience are images of nature, natural materials, natural colours, and information richness.

Figure 16 shows that they consider the use of water and vegetation, to show the diversity of the natural world that exists in the environment, highlighting the attribute information richness.

In figures 17, 18 and 19, the architects used wood, as the chosen material, for the seating benches and the floor finish. In addition, they used different type of plants for the seating area showing a variety of plants used in the public areas, highlighting the attribute information richness (figure 17 and 18).

In figure 19, the architects incorporated the attribute images of nature by placing paintings of flowers on the walls. The use of natural material, wood, as a floor finish. Lastly, they used blue covers on the windows, the colour of water and the sky, representing natural colours (image 2).

3. The experience of space and place

The experience of space and place is the spatial features from the natural environment that is used to enhance the health and wellbeing of the user (Kellert and Calabrese, 2015). The attributes used for this experience are transitional spaces, mobility and wayfinding, and prospect and refuge.

In figure 16, image 1, it is clear that they take into account the circulation of the users on the exterior of the hospital, and how they can have access to a different part of the building, highlighting the attribute mobility and wayfinding.

In figure 17, it is a transitional space because people use to have access to the other buildings, connecting the interior with the exterior (Image 1). In image 3, it is clear that there is enough space for people to walk freely. It shows a space that provides safety and security, having a long view of nature and the sky, providing a transitional space and prospect and refuge (Image 1).

In figure 18, it is used the attribute transitional spaces showing a space that the people can use to have a connection to the interior of the hospital (Image 2). Lastly, in figure 19, the windows in all the rooms give the patients the chance to have the view of the outside, providing prospect.

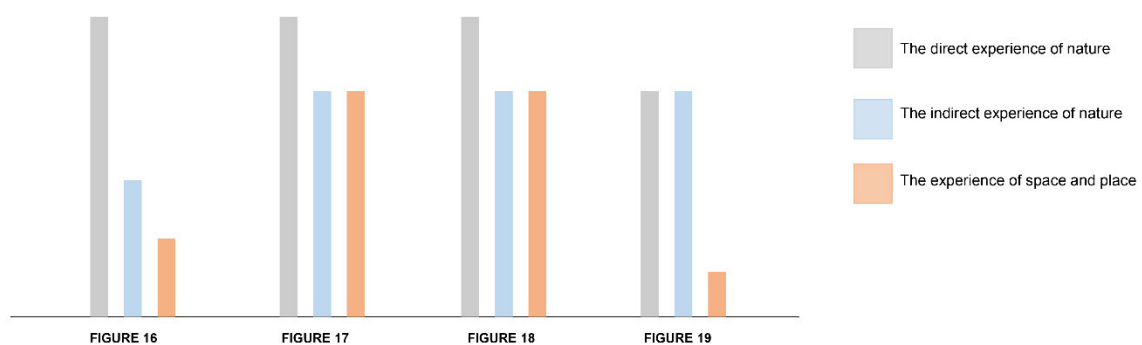


Figure 20: Filipe, 2020. Khoo Teck Puat Hospital, The 3 experiences of nature overall diagram (Filipe, 2020)

Overall, the experience of nature that is more predominant is the first experience, the direct experience of nature, showing that the architects consider the use of plants, water, daylight and natural ventilation, during the design process. For the second experience, the indirect experience of nature, the architects focus on implementing natural materials and image of nature specifically for the rooms. Lastly, for the experience, the experience of space and place, the architects focused on implementing transitional space, specifically in the public areas. Available in figure 20.

4.2.1.3.2 The 14 Patterns of Biophilic Design Categories

1. Nature in a Space

As mentioned in the literature review, the first category, nature in a space, is the direct experience with the natural world with the people physical senses (KMB architects, 2019). The patterns used in this category are the visual connection with nature, non-rhythmic sensory stimuli, presence of water, dynamic and diffuse light, and Connection with Natural System.

For the visual connection with nature pattern, figure 16 shows how the user will have access to nature inside the building, showing the direction of the windows. The outdoor seating area is surrounding by nature (figure 17). In figure 18, they introduced natural elements such as plants, daylight, natural ventilation and opportunity to see the rain by providing large windows. In figure 19, they used big windows in the rooms, so that the patients have a view to the outside.

For the Non-Rhythmic Sensory Stimuli pattern, they show that the user has a view of the sky, the sounds around the space, and fresh air while seating outside (figure 17).

For the presence of water pattern, it shows how they took full advantage of the existing pond existing in the site, making the view for most of the window be in the direction of the pond (Figure 16).

For the pattern dynamic and diffuse light, the plants provide shadow, so that there is a variation on the intensity of daylight coming through the windows (Figure 17). In figure 18, the design elements used in the skylight, it also reduce the intensity of natural light that comes into space (image 4). Lastly, in figure 19, they cover the windows, so that they reduce the intensity of the natural light in the rooms (Figure 19).

2. Natural Analogue

The second category, natural analogue, is the indirect evocation of nature (KMB architects, 2019). The patterns used in this category are biomorphic forms and patterns, and material connection with nature.

In figure 16, the form of the building shows complexity and order, showing how they managed to introduce vegetation, water in the circulation area and the structure of the building.

For the pattern Biomorphic Forms and Patterns, they used a different shape for the benches, instead of having them straight (Figure 17). In figure 19, the paintings on the wall bring different forms and pattern, in the rooms. In figure 17, 18, and 19 they use wood for the benches and floor finishes, highlighting natural materials and textures, using the pattern material connection with nature.

3. Nature of a Space

Nature of a Space is the spatial configurations that evoke a human response, which based on natural analogies (KMB architects, 2019). The patterns used in this category are mystery, refuge and risk/peril.

For the pattern mystery, figure 17 shows the position of the plants, which gives a sense of mystery, in the way that they are positioned (image 3). For the pattern refuge, this space is used for the visitors while they are waiting for their relatives, a waiting area (figure 17, image 1 and 3). At the same time, it is used as a waiting area for the visitors (Figure 18, image 1 and 3). For the pattern risk/peril, the marking strip, on the bottom of the windows protects people for falling when it is open. It is placed in all the windows in all hospital bedrooms as we can see in all the images (Figure 19).

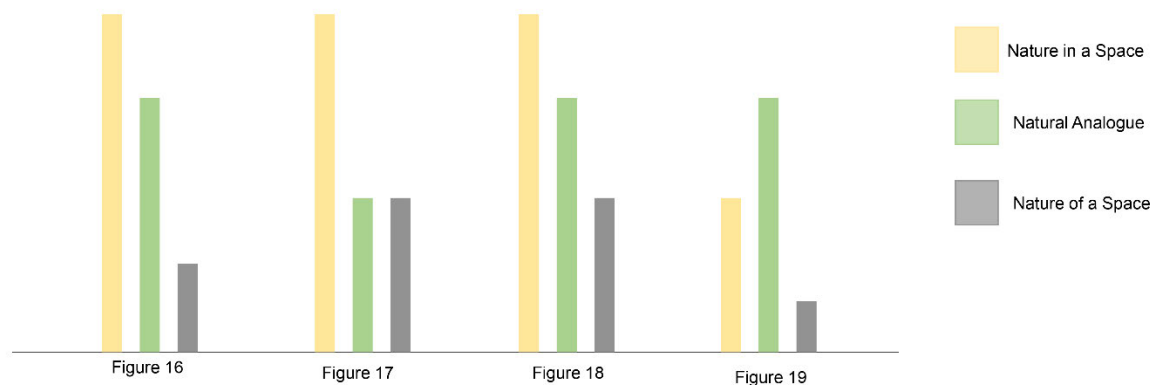


Figure 21: Filipe, 2020. Khoo Teck Puat Hospital, The 14 Patterns of Biophilic Design Categories, overall diagram. (Filipe, 2020)

Overall, the category that it is more predominant is the first category, nature of space, showing that the architects consider using design strategies that make the user be surrounded by nature. For the second category, focus on the pattern that uses a material that is connected to nature. Available in figure 21.

4.2.2 Umkhumbane Community Health Centre

Architects: ZAI Architects, Robert Johnson Architect and Associates.

Location: Durban, South Africa

Client: Cato Manor Development Association

Completion date: November 2003

Total floor area: 4230 m²

Sector: Healthcare

Project Value: R 53, 35 Million

4.2.2.1. Justification of the Case Study

The Umkhumbane Community Health Centre is a public health facility situated in Cato Manor area, close to the Durban CBD. In an area that consists of low-income communities, in rapid urban growth (Reddy, 2017). The project received the KwaZulu-Natal Regional Award in 2005, because of their ‘‘typological inventiveness’’, the way that they engaged with the site and how careful they were regarding the user experience (COROBRICK, 2004). The architects focused on the concept of a ‘‘place and wellness’’, focusing on the health instead of illness (Mngoma, 2014; Verster, 2010).

The centre is designed in a way that allows natural ventilation, lighting, and internal planting courts (Sanders, 2011). In addition, it focuses on services that provide lifestyle, nutrition and diet, exercise, urban agriculture, and different forms of therapy and counselling (Sanders, 2011; Reddy, 2017). They want a space that focuses on ‘‘learning, teaching and intellectual exchange’’ (Sanders, 2011; Verster, 2010). Robert Johnson Architect & Associates were appointed as lead Architect in an association with ZAI Consultants, where it was used 50% of the skilled labour and 100% of the unskilled labour from the local community (Sanders, 2011). The design of the centre was designed in a way, where the double volume 'spine' would orientate the people when walking through the building (Zai: Architects and consulting engineer. s.a).

4.2.2.2 Visual Analysis

The visual analysis is divided into three areas, they are: technical drawing analysis, exterior areas analysis and interior areas analysis with public areas 1 and 2.

1. Technical Drawing

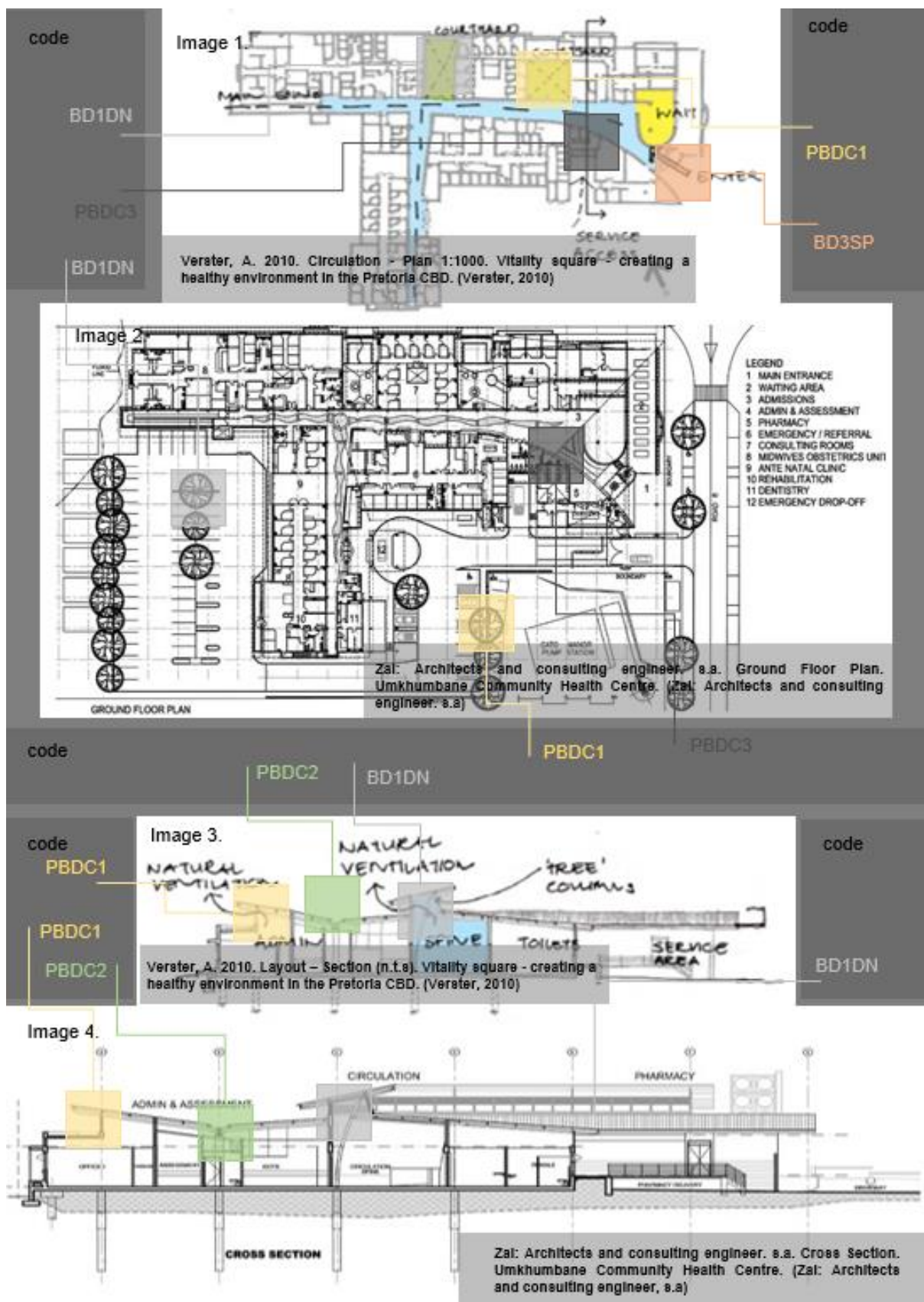


Figure 22: Filipe, E. 2020. Umkhumbane Community Health Centre Technical Drawings, diagram visualised by the author. (Filipe, 2020)

2. Exterior Spaces



Figure 23: Filipe, E. 2020. Umkhumbane Community Health Centre Exterior Spaces, diagram visualised by the author. (Filipe, 2020)

3. Interior Spaces

- Interior Spaces - public areas 1

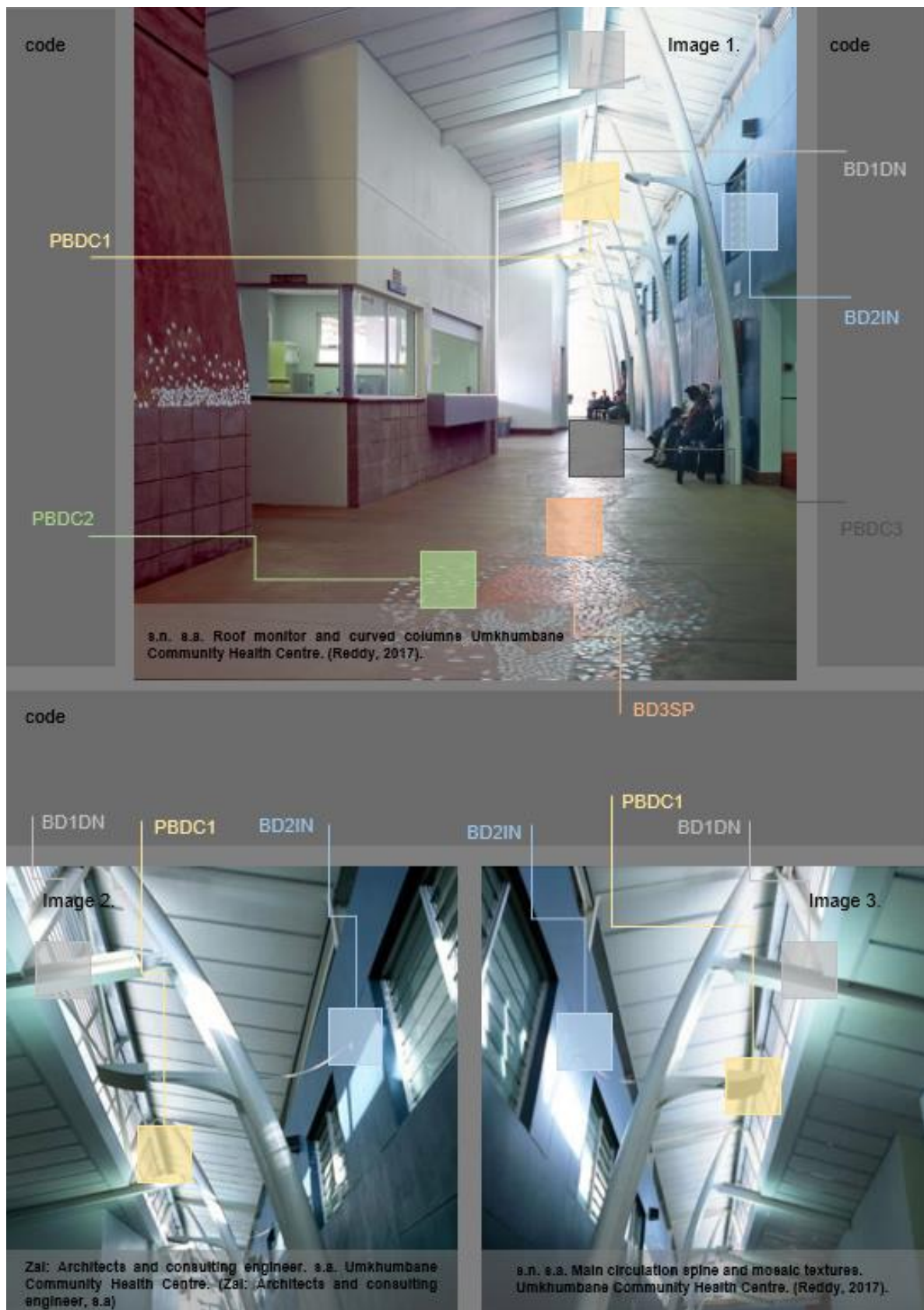


Figure 24: Filipe, E. 2020. Umkhumbane Community Health Centre Interior Spaces, main circulation, diagram visualised by the author. (Filipe, 2020)

- Interior Spaces - public areas 2

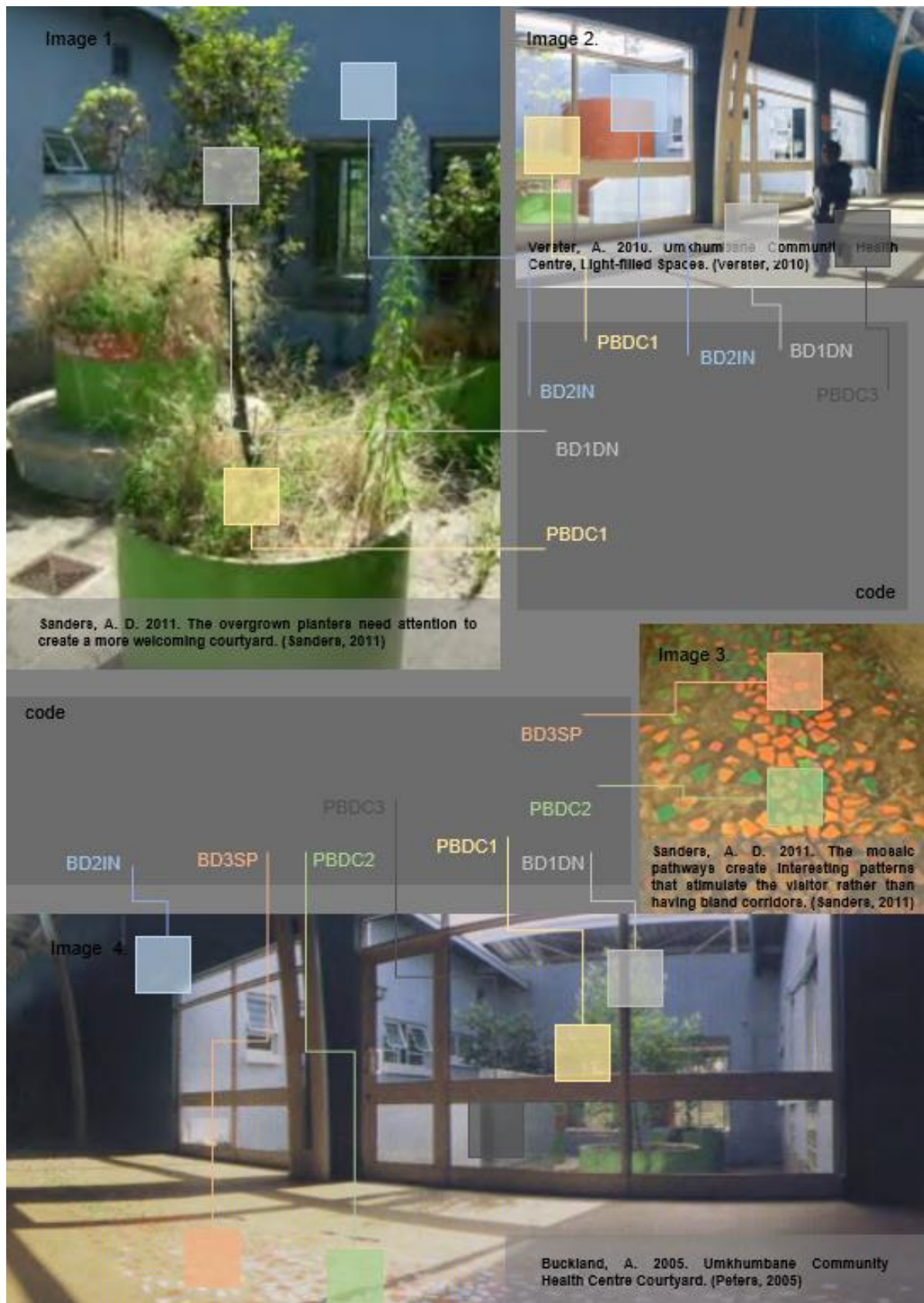


Figure 25: Filipe, E. 2020. Umkhumbane Community Health Centre Interior Spaces, courtyard, diagram visualised by the author. (Filipe, 2020)

4.2.2.3 Discussion of Findings

4.2.2.3.1 The Three Experiences of Biophilic Design

1. The direct experience of nature

As it was mentioned earlier, this experience focuses on the actual contact of people to the natural features in the built environment (Kellert and Calabrese, 2015). The attributes used for this experience are light, air, plants.

In figure 22, ZAI Architects and Robert Johnson Architect placed a courtyard in the interior of the hospital to bring daylight and natural ventilation, and present plants in the space (image 1). Image 3 and 4 show the design of the roof that allows for natural ventilation and daylight in the interior of the hospital. Highlighting the attribute of natural light, air and plants.

In figure 23, it is available the exterior area of the hospital. The architects focused on introducing the attribute of plants into the hospital, by adding vegetation in one of the entries (image 1). Large windows are introduced, in order to provide natural ventilation and daylight in the interior (image 2).

In figure 24, it is available the main circulation area of the hospital. They introduced the attribute of light and air in the main circulation area. Image 2 and 3 provide the design on the roof and the top window, introducing natural ventilation and daylight in the interior of the facility.

In figure 25, it is available the public areas in the interior of the center. Showing the courtyard, the design strategy used to bring daylight, natural ventilation and the introduction of plants in the interior of the space.

2. The indirect experience of nature

As it was mentioned earlier, this experience focuses on the contact with characteristics that represent the natural environment (Kellert and Calabrese, 2015). The attributes used for this experience are natural colours and naturalistic shapes and forms.

The architects incorporate the attribute natural colours, by using the colour blue to paint the walls, a colour that mimics water and sky (Figure 24 and 25). For the attribute naturalistic shapes and forms, the architects designed the columns, connecting to the top windows, to have a leaf-like pattern (figure 24).

3. The experience of space and place

As it was mentioned earlier, this experience focuses on spatial features from the natural environment that is used to enhance the health and wellbeing of the user (Kellert and Calabrese, 2015). The attributes used for this experience are transitional spaces, mobility and wayfinding, and prospect and refuge.

For the attribute of transitional spaces, it is clear how the users will navigate to space, having the hallway as the main passage. The main circulation is in the middle and the different rooms are on the sides (Figure 22). The courtyard is also a transitional space, it connects the interior and exterior spaces (image 1). Figure 24 shows the hallways that give access to other rooms showing how we can successfully navigate the environment (image 1). In figure 25, it is available the courtyard, showing how they connect the interior and the exterior spaces (image 1, 2 and 4).

For the attribute of Mobility and wayfinding, in figure 22, it is clear that it will be very easy to move freely in the space, as we can see on the space layout (image 1 and 2). In figure 24 and 25, the mosaic on the hallways showing the ways of the main circulation as well as providing an interesting pattern so that the passage does not look plane.

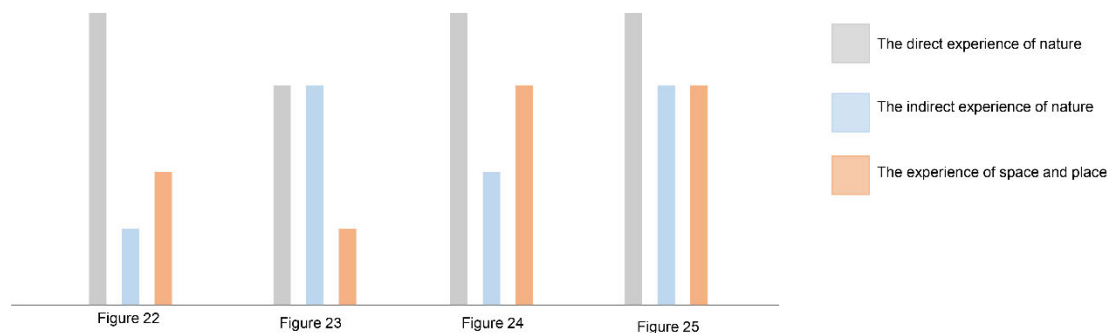


Figure 26: Filipe, 2020, Umkhumbane Community Health Centre, The Three Experiences of nature overall diagram. (Filipe, 2020)

Overall, the experience of nature that it is more predominant is the direct experience of nature and the experience of space and place. For the first experience, the architects focused on design strategies that bring natural ventilation and daylight into space. For the third experience, the architects focused on the wayfinding system, the hallway area as the main circulation area. They also use natural colours, for the second experience. Available in figure 26.

4.2.2.3.2 The 14 Patterns of Biophilic Design Categories

1. Nature in a Space

As it was mentioned earlier, nature in a space is defined as the direct experience with the natural world with the people physical senses (KMB architects, 2019). The patterns used in this category are visual connection with nature, non-visual connection with nature, and dynamic and diffuse light.

For the visual connection with nature pattern, in figure 22 (image 1) and figure 25 (image 1, 2 and 4), it shows the design and position of the courtyard, how it makes possible to have a visual connection with nature, providing plants, daylight, wind and rain. To bring natural elements inside the building. In figure 24, the design of the ceiling provides natural light or daylight in the interior of the building.

For the non-visual connection with nature pattern, figure 24 shows how the daylight demonstrates the direction to the exterior of the building so that the user knows exactly where the exit is (image 1).

For the dynamic and diffuse light pattern, the design of the ceiling shows how the architects manipulate the amount or intensity of daylight that will come inside the hospital (Figure 24). In figure 25, the dimensions of the windows show that they are high enough to daylight in the interior but not too much that the user will feel uncomfortable.

2. Natural Analogue

As it was mentioned earlier, natural Analogue is defined as the direct experience with the natural world with the people physical senses (KMB architects, 2019). The pattern used in this category is the biomorphic forms and patterns.

In figure 22, it shows a different design for the ceiling, to provide natural light and ventilation in the interior of the building (image 3 and 4). In figure 23, the front wall of the hospital, having the name of the facility, an interesting view from the outside (image 2). In figure 24, the mosaic on the floor and in the wall, it shows to make the space richer, instead of having just a plain walkway, so that change a monotonous space into a cognitively rich space (image 1). In figure 25, the design of the ceiling also makes the area unique and rich.

3. Nature of a Space

As it was mentioned earlier, the nature of a space is defined as spatial configurations evoke a human response, based on natural analogies (KMB architects, 2019). The patterns used in this category are mystery, refuge and prospect.

For the pattern mystery, the shape of the wall in the main circulation area gives the sense the desire to be discovered on what is inside (Figure 22).

For the pattern prospect, the walkways and the open floor giving the users a maximum of the viewpoint of the space (Figure 24). In addition, the windows from floor to ceiling that allow natural light into space (Figure 25)

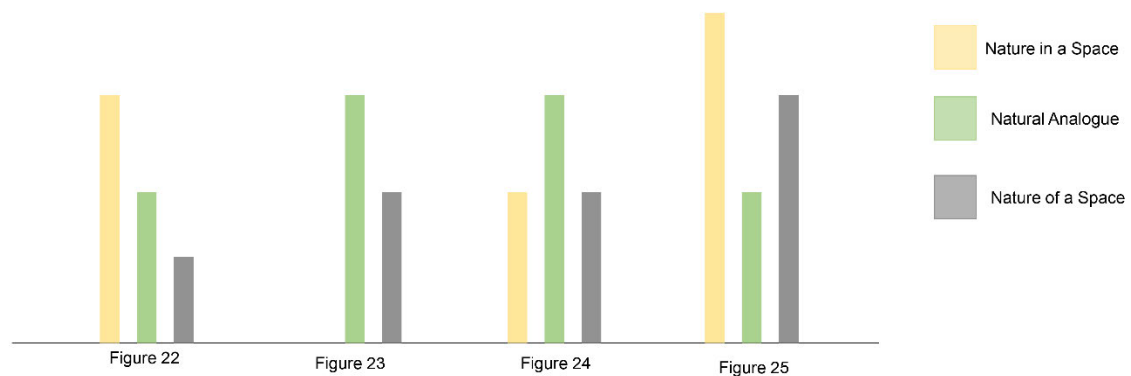


Figure 27: Filipe, E. 2020. Umkhumbane Community Health Centre, The 14 Patterns of Biophilic Design Categories overall diagram. (Filipe, 2020)

Overall, for the pattern of biophilic design categories, the predominant category is nature in a space focusing on the pattern visual connection with nature, specifically focusing on natural ventilation and daylight, and the pattern thermal and airflow variability. For the category nature of a space, focusing on the pattern mystery when walking into the main circulation area. Available in figure 27.

4.3 CROSS - SECTION ANALYSIS

In the following figure, it is available the similarities in the themes and differences that the two cases present, in terms of the design intervention used in biophilic design.

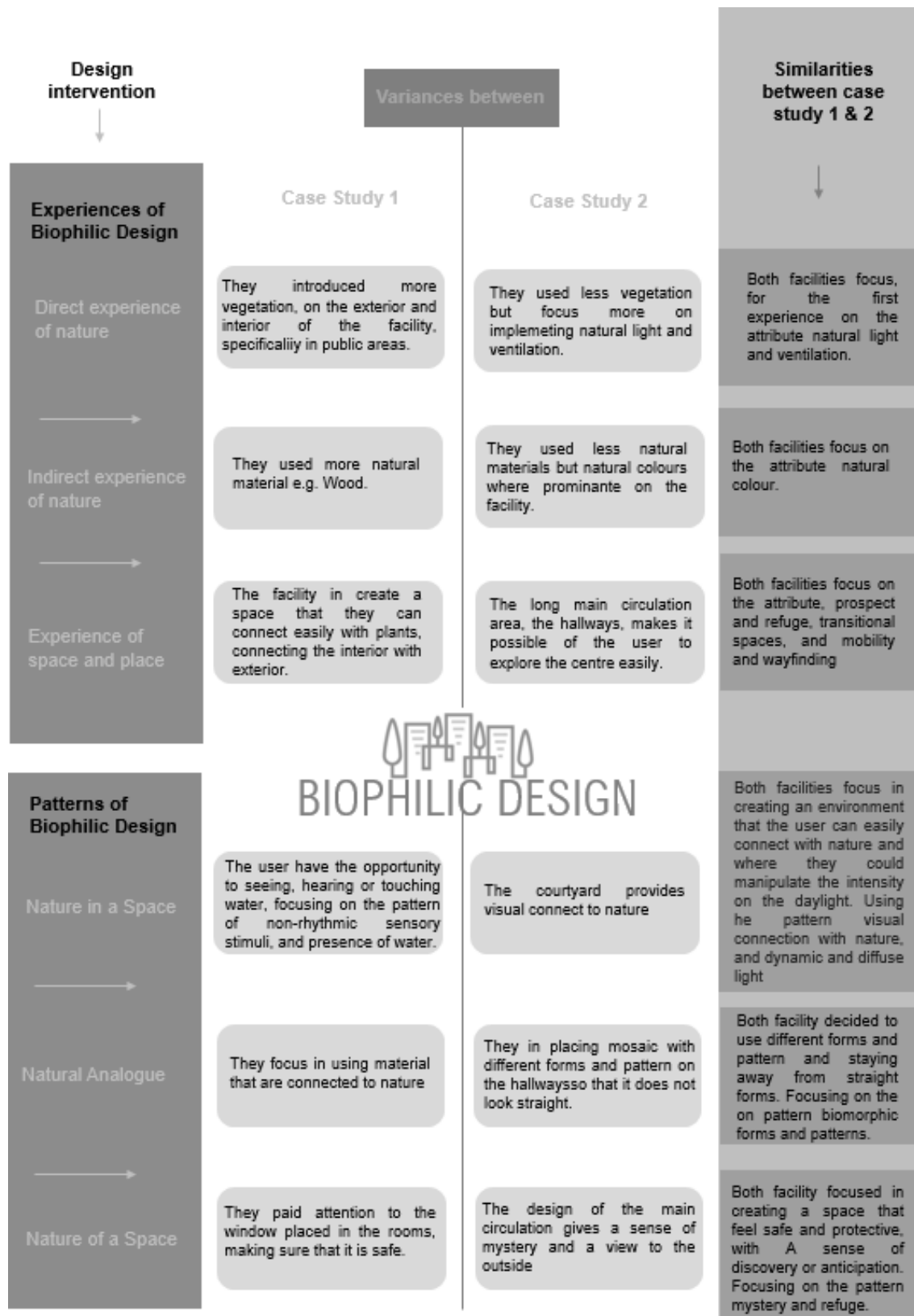


Figure 28: Filipe, E. 2020. Cross – section Analysis, diagram visualised by the author. (Filipe, 2020)

4.4 VALIDITY AND TRUSTWORTHINESS

For a researcher doing a qualitative study, the suitable concept is trustworthiness, to measure the reliability and validity of the study. In addition, the study is based on the cause and effect aspects that it is measured (Koonin, 2014). The trustworthiness is divided into four areas. The first area is credibility, which focuses on having accuracy in the research. The second area is transferability, which focus on transferring properly the collected data and analysed them. The third area is dependability, which is achieved by integrating all data available properly. Lastly, we have confirmability, which focuses on making sure that the collected data supports the analysis, and avoids being bias (Lincoln and Guba, 1985. Cited in: Koonin, 2014). The study used more than one method to collect the data, focusing on triangulation. In addition, we used qualitative content, conceptual and visual analysis and a thick description of the projects used in the case studies to make sure that we have enough data.

For the validity and reliability in the case study research, it focuses on constructing validity, specifically internal validity, external validity, concurrent validity, reliability and avoidance of bias (Koonin, 2014). For the internal validity, the study made sure that all the data matched, making sure that the analysis, interpretation and explanation are from the collected data. For external validity, we clarified the theory and concepts. The concurrent validity focuses on using multiples sources to collect the data. The reliability focus on making sure that the data was consistence. Lastly, the avoidance of bias focus on avoiding being selective during the data, no personal interpretation.

4.5 SECTION SUMMARY

This investigation focused on analysing two cases studies, using content and visual analysis of two cases study. The first case is the Khoo Teck Puat Hospital, and the second case is the Umkhumbane Community Health Centre. They were all discussed according to the design intervention found in biophilic design. The design interventions used are the three experiences of biophilic design and the 14 patterns of biophilic design. Lastly, a cross-section analysis was performed, in order to find the common themes and variances between them.

CHAPTER 5: CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter focus on discussing the conclusions, implications and recommendations for further research as well as the contribution that this research has on the interior design field, on the healthcare field and the industry. Lastly, we focus on the recommendations for further research that they study presents, along with the ethical implication.

5.2 CONCLUSION DRAWN FROM THE FINDINGS AND IMPLICATIONS

The academic sources consulted at the literature review provided information about the principles used to apply biophilic design in the built environment. Biophilic design has become a very important area, specifically in the design of interior spaces. A concept that researchers are focusing more because of the impact that they have, in the aesthetic of the space, the user's experience, and on the environment. Researches show that in the healthcare facilities, patients that are exposed to nature tend to reduce the need for pain medication, reduction of blood pressure, pain relief, improve recovery, accelerate healing, enhance staff morale and performance, and lead to fewer conflicts (Kellert and Calabrese, 2015). With that, it is becoming more important to focus on their application in the built environment. The study aimed to explore the design process used by interior designers and architects, focusing on the intrusion of biophilic design in the design of a healthcare facility.

- **Research Question One**

The first secondary question of this research was to explore the principles used on the application of biophilic design in the built environment, to gain knowledge before it is applied in the built environment. This was achieved through information coming from the academic sources consulted in the literature review.

We looked at the three kinds of experience of nature, which are part of the biophilic design framework. The first experience focus on the direct connection of human to nature, the second focus on the elements that allow humans to connect indirectly with nature, and the third experience focus on using the spatial

characteristic that enhances human health and wellbeing (Kellert and Calabrese, 2015). In addition, the 14 patterns of the biophilic design proposed by W.D.Browning, C.O.Ryan, and J.O.Clancy in 2014 were discussed (Downton, Jones, Zeunert and Roös, 2017). They are divided into three categories. The first category, nature in the space, focus on the first seven patterns; the second category, natural analogues, are the eight, nine and ten pattern; and the third category, nature of the space, are the last four patterns.

With that, it was possible to identify the different design strategies applied in the built environment. The information gathered in the literature review helped to identify the experiences of nature and the fourteen pattern in the visual analysis. The application of biophilic design is considered during the conceptualization stage and the design process, for both exterior and interior spaces. They are both a good example that shows design elements that will help the application of biophilic design in the built environment.

- **Research Question Two**

The second secondary question of this research was to identify the guiding theories and elements used in the design process of a healthcare facility and the different stages used by the professionals to have the completed and final result. The question was achieved through the information coming from the literature review. Subsequently, the question provided information on what is necessary for the design of a healthcare facility. In addition, the design stages used in the design process are explored, so that it is possible to identify when the biophilic design is introduced in the hospital.

Healthcare is an area that focused traditionally on the functionality and the services that space provides. Now, it is very important to look at how the patients experience the space (Ulrich, 1997; 2003). Two emerging fields are used in the healthcare field. The theory and framework, psychosocially supportive design, and the discipline and emerging field, evidence-based design.

In addition, the different stages used in the healthcare field is discussed. The eight design process developed by the Royal Institute of British Architects (Hicks,

McGovern, Prior and Smith, 2015). Biophilic design is considered during the third stage, concept design, and the fourth stage, developed design. Lastly, the seven stages used in the design process of a healthcare facility, showing the different events and decisions made during the project (Carpman and Grant, 2016). Biophilic design is considered during the second stage, the design stage, and during the third stage, the concurrent planning stage

- **Research Question Three**

The third secondary question of this research was to explore the application of the guiding principles of biophilic design in the design of a healthcare facility. The answer to this question was achieved by applying the information gathered in the literature review to the real-life projects explored on the case studies. It was identified the three experiences of nature and their respective attributes, and the fourteen patterns of biophilic design, to understand how this concept is applied in the healthcare field. Vast studies are available that specify that the natural environment is very important in the recovery of the patients.

The two case studies focus on showing how existing hospitals introduced the concept of biophilic design in the design of the facility. The first analysis, we focused on the international hospital, Khoo Teck Puat, located in Singapore. The second analysis, we focused on the local hospitals the Umkhumbane Community Health Centre located in Durban, looking at design strategies used by the architects.

The visual analysis looked at two different areas, exterior and interior spaces, on how they manage to implement different design strategies in both spaces. During the visual analysis, it was possible to identify small as well as big design intervention made by the architects during the design process. Both hospitals focused on increasing the direct contact with nature, such as natural light, ventilation, plants, water and material with natural texture, since that it was very predominant in both areas of the hospital. For the indirect connection, the use of natural colours and natural materials was very common. For the experience of place in space, both hospitals focused on the wayfinding systems and providing transitional spaces. In addition, the Khoo Teck Puat hospital focused mainly on

the implementation of plants, increasing the connection to greenery, the use of natural materials, and transitional spaces. The Umkhumbane Community Health Centre focused more on providing natural light and ventilation in the interior of the space, the use of natural colour, wayfinding systems.

Overall, it is clear that the developed experiences and their corresponded attributes, and the fourteen patterns are both an effective design intervention to introduce biophilic design in the healthcare field. It influences the wellbeing of the users, the design and aesthetic of the building. To introduce biophilic design, we need to understand all the requirements needed for the application, by researching the experiences, attributes and patterns. Secondly, we need to start to consider them during the conceptualization process. Lastly, find different design strategies to apply the experiences. In addition, the cross-section analysis showed the differences and the similarities in design strategies that both hospitals used to introduce biophilic design in the hospitals. Showing that there are numerous ways to introduce biophilic design and increase the connection of human to nature.

5.3 CONTRIBUTION TO THE FIELD

The most important contribution of the study is to have a look on the design process used by designers, specifically for interior design students that want to have a deep understanding on the design of healthcare facility and the intrusion of biophilic design. The wellbeing of the occupants of a building is a very important aspect to take in consideration during the design process and have more material about it, especially for patients of a hospital because, it is a very complex design, contributing for to the academic area of interior design.

The study contributes to the interior design field, as it provides different ways to implement the concept of biophilic design. It allows looking at the guiding principles and theories that we need to keep in mind when designing a healthcare facility. The contribution to the healthcare field focuses on providing a space that aims at the wellbeing of the patients, visitors and staff member. It also shows how it is important for the patients to have contact with the natural environment,

showing that designers play a big part in the healing process of the patients. The contribution to the built environment industry, specifically in South Africa, by providing examples of how countries overseas are treating their hospitals regarding the introduction of the concept of biophilic design.

René Dubos says that we can create new environments that are ecologically sound, aesthetically satisfying, economically rewarding (Kellert, and Calabrese, 2015). The sentence summarises the benefits of the research on the world. Working with the environment and their elements that are in our disposal, instead of eliminating the natural elements. The biophilic design provides a beautiful space for the patients, instead of having white space, and only showing the medical equipment. With the fast recovering process, and using less pain medication, the patients will not spend a lot of money on pain medication.

5.4 ETHICAL IMPLICATIONS

Ethical consideration focus on personal integrity level that the research has but this implications are more than individuals, and when looking at the integrity, the researcher focus ethical standard principles and professional that are necessary for the study (Louw, 2014).

All the material consulted on the literature review were correctly referenced, and all the principle author materials were mentioned. During the data collection, the study made sure that all the data and the projects were properly referenced, and the materials coming from the secondary sources are from academically credible sources. Making sure that all the information is correct. In the case studies, we looked at two existing projects focusing on information, drawing and photographs existing on the internet. It was very important to make sure that all the information are correctly referenced and that all the people that are part of the projects were mentioned.

5.5 FURTHER RESEARCH AND CRITIQUE OF THE RESEARCH

During the research, we encountered a few limitations that influenced, directly and indirectly, the study. Further research is essential because it will be beneficial for many areas, specifically for the wellbeing of the user in the healthcare facility.

The first limitation that the study encounter is the time limit. Due to the time, it was not possible to collect more data, to build more on the interpretation and discussion of the finding. With a longer data collection period, it would be possible to talk with architects and designer that focus on the healthcare field and observation of the space. Secondly, the global pandemic that the world is currently going through was also a limitation. Not being able to conduct a direct observation or interview, and see the patients experiencing the space, for primary data. Thirdly, the limited information access was also a limitation. Access to information was a challenge, and we had to rely on the one that is available on the internet. Basing our data on the information that people have worked on.

Although there are limitations to this study, this study holds the potential for further future research. The study presents a big opportunity for future research because primary research is necessary. When the global pandemic is over, it will be valuable for personal observation research, to see personally the introduction of biophilic design in different areas of the hospital. In addition, it will be valuable to see how the hospital in South Africa treated their hospital regarding this concept.

REFERENCE LIST

Abbasa, M. Y. and Ghazalib, R. 2010. Healing environment of pediatric wards. *Procedia Social and Behavioral Sciences* 5 (2010) 948–957. [Online]. Available at: <https://www.sciencedirect.com/science/article/pii/S1877042810015892?via%3DIihub> [Accessed 20 July 2020].

Archdaily. 2019. IT'S Biofilia Office / IT'S Informov, 31 December 2019. [Online]. Available at: https://www.archdaily.com/920540/its-biofilia-office-its-informov?ad_source=search&ad_medium=search_result_all [Accessed 05 December 2020].

ArchDaily. 2020. Maggie's Leeds Centre / Heatherwick Studio, 12 June 2020. [Online]. Available at: https://www.archdaily.com/941540/maggies-leeds-centre-heatherwick-studio?ad_source=search&ad_medium=search_result_all [Accessed 20 July 2020].

Auriacombe, C.J. 2016. Towards the construction of unobtrusive research techniques: Critical considerations when conducting a literature analysis. *Centre for Public Management and Governance, University of Johannesburg, South Africa*, Volume 9 number 4 • December 2016, PP. 1-19. [Online]. Available at: https://repository.up.ac.za/bitstream/handle/2263/59036/Auriacombe_Towards_2016.pdf?sequence=1&isAllowed=y [Accessed 04 September 2020].

Auriacombe, C.J. and Meyer, N. 2020. The Importance of Qualitative and Unobtrusive Research Methods within the Broader Concept of Meaning-Making. *International Journal of Innovation, Creativity and Change*. Volume 13, Issue 1, 2020. [Online]. Available at: https://www.ijicc.net/images/vol_13/13158_Auriacombe_2020_E_R.pdf [Accessed 04 September 2020].

Beatley, T. 2011. *Biophilic Cities: Integrating Nature into Urban Design and Planning*. Washington: Islandpress.

Bezuidenhout, R.M and Franci Cronje, F. 2014. Qualitative data analysis. In: du Plooy-Cilliers, F., Davis, C. and Bezuidenhout, R.M. eds. 2014. *Research matters*. Claremont: Juta, Chapter 16: 228-250.

Blom, M. 2013. *Biophilic Architecture and its Influence on Human Behaviour and Well-Being: A Proposed Urban Multi-use Office Park Development*. ARCH Dissertation. University of KwaZulu-Natal.

Bringslimark, T., Bysheim K. and Nyrud A.Q. 2010. DESIGN AND HEALTH: EVIDENCE-BASED BIOPHILIC DESIGN. *International Council for Scientific Development*, pp. 35- 163. [Online]. Available at:

<https://s3.amazonaws.com/academia.edu.documents/6034568/foresthealth-swb-spes-ed-2010.pdf?> [Accessed 30 April 2020].

Business Research Methodology. s.a. Inductive Approach (Inductive Reasoning). [Online]. Available at: <https://research-methodology.net/research-methodology/research-approach/inductive-approach-2/> [Accessed 04 September 2020].

Caixeta, M.C.B.F. and Fabricio, M.M. 2012. A conceptual model for the design process of interventions in healthcare buildings: a method to improve design. Journal of Architectural Engineering and Design Management, volume 9, pp. Pages 95-109. [Online]. Available at: <https://www.tandfonline.com/doi/abs/10.1080/17452007.2012.738040> [Accessed 04 July 2020].

Cama, R. 2009. Evidence-Based Healthcare Design. New Jersey: John Wiley & son, Inc.

Carpman, J.R. and Grant, M.A. 2016. Design That Cares: Planning Health Facilities for Patients and Visitors. San Francisco: Jossey bass, Wiley brand.

CPG consultants. 2020. Khoo Teck Puat Hospital: Projects. [Online]. Available at: http://www.cpgcorp.com.sg/cpgc/Project/Project_Details?ProjectID=1068#1 [Accessed 19 September 2020].

Cohen, L., Manion, L. and Morrison, K. 2018. Research Methods in Education. New York: Taylor & Francis Group.

COROBRIK. 2004. Journal of the KwaZulu-Natal Institute for Architecture [Online]. Available at: <https://www.kznia-journal.org.za/sites/default/files/KZNIA%202-2005%20E.PDF> [Accessed 19 September 2020].

Davidson, D. 2013. Integrating Biophilic Principles and Therapeutic Design Elements in Outdoor Spaces for Children at Tucson Medical Center. Master of Landscape Architecture. The University of Arizona.

Davis, C. 2014. What is research?. In: du Plooy-Cilliers, F., Davis, C. and Bezuidenhout, R.M. eds. 2014. Research matters. Claremont: Juta, Chapter 1: 1-17.

Designcurial. 2019. Biophilic Design and Architecture - 10 of the best Biophilic Buildings. [Online]. Available at: <http://www.designcurial.com/news/biophilic-design-and-architecture---10-of-the-best-biophilic-buildings-4527750/7> [Accessed 19 September 2020].

Dilani, A. 2009. Psychosocially Supportive Design: A Salutogenic Approach to the Design of the Physical Environment. 1st International Conference on Sustainable Healthy Buildings; Seoul, Korea. [Online]. Available at: https://www.researchgate.net/profile/Alan_Dilani/publication/265349464_Psychosocially_Supportive_Design_A_Salutogenic_Approach_to_the_Design_of_the_Physical_Environment/links/54b7be500cf2e68eb28047d0.pdf. [Accessed 30 April 2020].

Downton, P., Jones, D., Zeunert, J. and Roös, P. (2017). Biophilic Design Applications: Putting Theory and Patterns into Built Environment Practice. In The International Conference on Design and Technology, KEG, pages 59–65. DOI: 10.18502/keg.v2i2.596 [Accessed 30 June 2020].

Elwakad. 2019. Khoo Teck Puat Hospital, Biophilic Design. [Online]. Available at: <https://www.sutori.com/story/khoo-teck-puat-hospital--WHrNh4qxUKb8jJP48tMXdbYL> [Accessed 19 September 2020].

Etikan, I, Musa, SA and Alkassim, RS. 2016. Comparison of Convenience Sampling and Purposive Sampling. American Journal of Theoretical and Applied Statistics 2016; 5(1): pp. 1-4. [Online]. Available at: https://scholar.google.com/scholar?hl=ptPT&as_sdt=0%2C5&q=sampling+methods+purposive&oq=sampling+methods+p [Accessed 06 March 2020].

EVIDENCE SPACE. 2015. History of evidence based design, October 2015. [Online]. Available at: <https://www.british-gypsum.com/evidence-space/heal/history-of-evidence-based-design> [Accessed 30 April 2020].

Ghazali, R. and Abbas, M. Y. 2017. Paediatric Wards: Healing environment assessment. [Online]. Available at: <https://aje-bs.e-iph.co.uk/index.php/aje-Bs/article/view/191/202> [Accessed 20 July 2020].

Gillis, K and Gatersleben, B. 2015. A Review of Psychological Literature on the Health and Wellbeing Benefits of Biophilic Design. Department of Psychology, Faculty of Arts and Humans Sciences, University of Surrey, Guildford, Surrey GU2 7XH. [Online]. Available at: <https://www.mdpi.com/2075-5309/5/3/948/html>. [Accessed 30 April 2020].

Glaw, X., Inder, K., Kable, A. and Hazelton, M. 2017. Visual Methodologies in Qualitative Research: Autophotography and Photo Elicitation Applied to Mental Health Research. [Online]. Available at: <https://journals.sagepub.com/doi/full/10.1177/1609406917748215> [Accessed 04 September 2020].

GREENROOFS.COM. 2020. KHOO TECK PUAT HOSPITAL (KTPH). [Online]. Available at: <https://www.greenroofs.com/projects/khoo-teck-puat-hospital-ktph/> [Accessed 19 September 2020].

Gunce, K., Erturk, Z. and Erturk, S. s.a. Visual Interpretation of Architectural Form. [Online]. Available at: <https://www.irbnet.de/daten/iconda/CIB16713.pdf> [Accessed 04 September 2020].

Healing arts at Montifiore. 2020. Creating a Healing Hospital Environment. [Online]. Available at: <https://www.montefiore.org/healingarts-healing-environment> [Accessed 20 July 2020].

Hicks C., McGovern T., Prior G. and Smith I. 2015. Applying Lean principles to the design of healthcare facilities. International Journal of Production Economics 2015, 170(Part B), 677-686. [Online]. Available at: https://www.researchgate.net/publication/276881603_Applying_Lean_principles_to_the_design_of_healthcare_facilities [Accessed 12 June 2020].

Hsieh, H.F and Shannon, S.E. 2005. Three approaches to qualitative content analysis. Qualitative Health Research, 15(9):1277–1288. Cited in: Strydom, A. and Bezuidenhout, R.M. 2014. Qualitative data collection. In: du Plooy-Cilliers, F., Davis, C. and Bezuidenhout, R.M. eds. 2014. Research matters. Claremont: Juta, Chapter 13: 173-203.

Institute for Work & Health. 2015. Cross-sectional vs. longitudinal studies [Online]. Available at: <https://www.iwh.on.ca/what-researchers-mean-by/cross-sectional-vs-longitudinal-studies> [Accessed 04 September 2020].

International living future institute. s.a. Healing Through Nature: Khoo Teck Puat Hospital. [Online]. Available at: <https://living-future.org/biophilic/case-studies/award-winner-khoo-teck-puat-hospital/> [Accessed 19 September 2020].

Jiang, S. and Verderber, S. 2015. Landscape Therapeutics and the Design of Salutogenic Hospitals: Recent research. Design & Health Scientific Review. [Online]. Available at: <https://www.daniels.utoronto.ca/sites/default/files/stephen-verderber-1.3.pdf> [Accessed 26 July 2020].

Jones, P. 2013. Design for Care: Innovating Healthcare Experience. New York: Rosenfeld Media.

Kellert, S.R. 2008. Dimensions, Elements, and Attributes of Biophilic Design. In: Kellert, S.R., Heerwagen, J. and Martin, M. 2008. Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life. New Jersey: John Wiley and Son, Inc. Chapter 1: 3-19.

Kellert, S. R. and Calabrese, E. 2015. The Practice of Biophilic Design. [Online]. Available at: <http://www.xpuro.com/wp-content/uploads/2016/08/Biophilic-Design.pdf> [Accessed 03 April 2020].

Khoo Teck Puat Hospital, National Healthcare Group. 2020. EXPLORE KTPH. [Online]. Available at: https://www.ktph.com.sg/main/explore_ktph_pages/228/designed_for_comfort [Accessed 19 September 2020].

KMB architects. 2019. Biophilic Design: Application in Healthcare. [Online]. Available at: <https://www.kmb-architects.com/news/2019/3/12/biophilic-design> [Accessed 19 October 2020].

Koonin, M. 2014. Validity and reliability. In: du Plooy-Cilliers, F., Davis, C. and Bezuidenhout, R.M. eds. 2014. Research matters. Claremont: Juta, Chapter 17: 252-260.

Kyle, L. 2019. The Nature of Healing: Living Architecture for Long Term Care & Rehabilitation Hospitals. Master of Architecture in Engineering. The University of Waterloo.

Lee, S. 2011. Evaluating serviceability of healthcare servicescapes: Service design perspective. International Journal of Design, 5(2), 61-71.

LIT, L. T. 2012. From Vision to Reality, The Case of Khoo Teck Puat. Design and Health. Singapore: Khoo Teck Puat Hospital.

Marcus, CC. 2007. Healing Gardens in Hospitals. Interdisciplinary Design and Research e-Journal, pp. 1-27. [Online]. Available at: https://intogreen.nl/wpcontent/uploads/2017/07/cooper_marcus.pdf [Accessed 03 April 2020].

Marcus, C.C. and Barnes, M. 1995. Gardens in Healthcare Facilities: Uses, Therapeutic Benefits, and Design Recommendations. The Center for Health Design. [Online]. Available at: https://www.brikbases.org/sites/default/files/CHD_GardensinHCFacilityVisits.pdf [Accessed 04 July 2020].

Marcus, C.C, Barnes, M. 1999. Healing Garden: Therapeutic Benefits and Design Recommendations. New York: Wiley

McCullough, C.S. 2010. Evidence Based Design for Healthcare Facilities. Indianapolis: Sigma Theta Tau International.

Maree, K. (ed). 2007. First steps in research. Pretoria: Van Schaik. Cited in: Strydom, A. and Bezuidenhout, R.M. 2014. Qualitative data collection. In: du Plooy-Cilliers, F., Davis, C. and Bezuidenhout, R.M. eds. 2014. Research matters. Claremont: Juta, Chapter 13: 173-203.

McCrocklin, S. 2018. Primary vs. Secondary Research. GeoPoll. [Online]. Available at: <https://www.geopoll.com/blog/primary-vs-secondary-research/> [Accessed 04 September 2020].

Maxwell, J. A. 2005. *Qualitative Research Design: An Interactive Approach* (second edition). Thousand Oaks, CA: Sage. Cited in: Cohen, L., Manion, L. and Morrison, K. 2018. *Research Methods in Education*. New York: Taylor & Francis Group.

Mngoma, T.K. 2014. *Processes of Promotion of Well-being as a Generator of Built Environments: The Design of a Community Healthcare Facility for Durban*. Dissertation. University of KwaZulu-Natal.

Mohandas, V. 2014. Demand for transitional care service at Khoo Teck Puat Hospital on the rise. [Online]. Available at: <https://www.todayonline.com/singapore/demand-transitional-care-service-khoo-teck-puat-hospital-rise> [Accessed 19 September 2020].

O'Donoghue, T. 2007. *Planning Your Qualitative Research Project: An Introduction to Interpretivist research in education*. New York: Routledge.
Oxford Advanced Learner's Dictionary. 2010. Oxford: Clarendon.

Pascoe, G. 2014. Sampling. In: du Plooy-Cilliers, F., Davis, C. and Bezuidenhout, R.M. eds. 2014. *Research matters*. Claremont: Juta, Chapter 11: 131-145.

Reddy, S. 2017. Using biophilic design as a tool for restorative architecture, toward a wellness centre in Durban. ARCH Theses. University of KwaZulu-Natal.
Rmjm. 2013. Khoo Teck Puat Hospital: Overview. [Online]. Available at: <https://www.rmjm.com/portfolio/khoo-teck-puat-hospital-singapore/> [Accessed 19 September 2020].

Ryan, C.O., Browning, W.D., Clancy, J.O., Andrews, S.L. and Kallianpurkar NB. 2014. Biophilic Design Patterns: Emerging Nature-Based Parameters for Health and Well-Being in the Built Environment. *International Journal of Architectural Research*. Archnet-IJAR, Volume 8 - Issue 2 – July 2014 - (62-76) – Regular Section. [Online]. Available at: <https://earthwise.education/wpcontent/uploads/2019/10/Biophilicdesign-patterns.pdf>. [Accessed 30 April 2020].

Salonen, H., Lahtinen, M., Lappalainen, S., Nevala, N., Knibbs, L. D., Morawska, L. and Reijula, K. (2013). Physical characteristics of the indoor environment that affect health and wellbeing in healthcare facilities: a review. *Intelligent Buildings International*, 5:1, 3-25. [Online]. Available at: <https://www.tandfonline.com/doi/pdf/10.1080/17508975.2013.764838?needAccess=true>. [Accessed 12 June 2020].

Sanders, A. D. 2011. Biophilia in architectural design: a healthcare and community centre for Mpumalanga, Durban. ARCH Theses. University of KwaZulu-Natal.

SKIDMORE. s.a. Writing and Research in Art History: Visual Analysis Guidelines. [Online]. Available at: <https://www.skidmore.edu/arthistory/academic/writing/visual.php> [Accessed 04 September 2020].

Strydom, A. and Bezuidenhout, R.M. 2014. Qualitative data collection. In: du Plooy-Cilliers, F., Davis, C. and Bezuidenhout, R.M. eds. 2014. Research matters. Claremont: Juta, Chapter 13: 173-203.

Trimtab. 2017. First Annual Stephen R. Kellert Biophilic Design Award Goes To Khoo Teck Puat Hospital. 9 November 2017. [blog]. Available at: <https://trimtab.living-future.org/blog/biophilic-design-award/> [Accessed 23 September 2020].

Totaforti, S. 2018. Applying the benefits of biophilic theory to hospital design. Totaforti City Territ Archit (2018) 5:1. [Online]. Available at: <https://link.springer.com/content/pdf/10.1186/s40410-018-0077-5.pdf> [Accessed 26 July 2020].

UKEssays. 2017. Research Onion - Explanation of the Concept, 18 May 2017. [Online]. Available at: <https://www.ukessays.com/essays/psychology/explanation-of-the-concept-of-research-onion-psychology-essay.php> [Accessed 04 September 2020].

Ulrich, R. S. 1997. EFFECTS OF INTERIOR DESIGN ON WELLNESS. Journal of healthcare design: proceedings from the ... Symposium on Healthcare Design. Symposium on Healthcare Design · February 1997. [Online]. Available at: https://www.researchgate.net/publication/12761803_A_theory_of_supportive_design_for_healthcare_facilities [Accessed 04 April 2020].

Ulrich, R.S. 2003. Evidence Based Environmental Design for Improving Medical Outcomes. [Online]. Available at: https://pdfs.semanticscholar.org/751a/0146c654bf2160273c03a13cbbb40f70085e.pdf?_ga=2.140509682.1380151855.1591985835-994941648.1583748918 [Accessed 30 April 2020].

Verster, A. (2010) Vitality square - Creating a Healthy Environment in the Pretoria CBD, Pretoria: University of Pretoria.

Vertical Green. 2018. Khoo Teck Puat Hospital – A Garden Hospital. [Online]. Available at: <https://www.verticalgreen.com.sg/a-garden-hospital/> [Accessed 19 September 2020].

Wallflower. 2020. Foodfare ktph. [Online]. Available at: <https://wallflower.com.sg/foodfare-ktph/> [Accessed 19 September 2020].

Wiid, J & Diggines, C. 2013. Marketing research. 2nd ed. Cape Town: Juta & Company. Cited in: Plooy-Cilliers, F.D., Davis, C. and Bezuidenhout R.M. 2014. Research Matters. Claremont, CL: JUTA.

Willis, J. W., Jost, M. and Nilakanta, R. 2007. Foundations of Qualitative Research: Interpretive and Critical Approaches. London: SAGE Publication. Inc

Zai: Architects and consulting engineer. s.a. Umkhumbane Community Health Centre. [Online]. Available at: <https://www.zaiarchitects.co.za/umkhumbane.htm> [Accessed 19 September 2020].

Zimring, C., Denham, M. E., Jacob, J. T., Cowan, D. Z., Ellen Do, Hall, K., Kamerow, D., Kasali, A. and Steinberg, J. P. 2013. Evidence-Based Design of Healthcare Facilities: Opportunities for Research and Practice in Infection Prevention. Infection Control & Hospital Epidemiology, 34, pp. 514-516 doi: 10.1086/67022 [Accessed 30 April 2020].

APPENDIX A: CONCEPT DOCUMENT TEMPLATE

RESEARCH PURPOSE/OBJECTIVE		RESEARCH PROBLEM	
The purpose is to analyse the design process of incorporating natural environment elements in hospitals.		The patient wellbeing, their comfort and a comfortable working area for the staff. To reduce the stress while recovering.	
PRIMARY RESEARCH QUESTION		SECONDARY QUESTIONS/ HYPOTHESES/ OBJECTIVES	
How can biophilic design be included in the interior design process of the interiors of healthcare facilities to promote patient well-being?		1. What are the guiding principles used in the application of biophilic design in the built environment? 2. What are the guiding theories used in the design process of a healthcare facility? 3. How are the guiding principles, used in the application of biophilic design, applied in the interior of a healthcare facility to promote the patients?	
SEMINAL AUTHORS/ SOURCES	- Roger S. Ulrich - Stephen R. Kellert - Alan Dilani.	KEY CONCEPTS	- Natural environment - Physical factors - Space arrangement - Opening position - Natural lighting and ventilation
RESEARCH RATIONALE	- To look further than just the functionality of the space and focusing more on the user's experience, especially in healthcare facilities, because they are in a delicate situation. - The connection to natural environment influence in a positive way especially for people need comfort and less stress.	KEY THEORIES	- BIOPHILIC DESIGN Healthcare Design - SUPPORTIVE DESIGN - EVIDENCE BASED DESIGN
LITERATURE REVIEW – CONCEPTUAL FRAMEWORK	1. BIOPHILIC DESIGN The Practice of Biophilic Design by Stephen R. Kellert and Elizabeth F. Calabrese. Biophilic Design: The Theory, Science and Practice of Bringing Building to Life by Stephen R. Kellert, Judith Heerwagen, Martin Mador. 2. SUPPORTIVE DESIGN Effects of Interior Design on Wellness by Roger S. Ulrich Psychosocially Supportive Design: A Salutogenic Approach to the Design of the Physical Environment by Alan Dilani. Psychosocially Supportive Design: As a Theory and Model to Promote Health by Alan Dilani. 3. EVIDENCE BASED DESIGN Evidence Based Environmental Design for Improving Medical Outcomes by Roger S. Ulrich. Evidence Based Design for Healthcare Facilities by Cynthia S. McCullough.		
PARADIGM	Interpretivism		
APPROACH	POPULATION	SAMPLING	
Qualitative Approach	Hospitals that applied the concept of biophilic design in their design process.	- a purposive sampling technique - Non-probability sampling	
DATA COLLECTION METHOD(S)	- Case Study Approach - Unobtrusive Research - Qualitative Content Analysis - Conceptual Analysis	DATA ANALYSIS METHOD(S)	- Content or textual analysis - Visual Data analysis - Coding
ETHICS		LIMITATIONS	
To give all the credits to the architect and the designer in the precedent study.		Covid 19, reach Architects and designers, not be able to do Interviews. Not be able to do an observation. time limit	
ANTICIPATED FINDINGS	The design of a healthcare facility is a very complex area. and there is emerging field that help with it. Supportive design and evidence based design	ANTICIPATED CONTRIBUTION	Academic, for student that have Interest in the design of a healthcare facility.
REFERENCES			
Etikan, I, Musa, SA and Alkassim, RS. 2016. Comparison of Convenience Sampling and Purposive Sampling. American Journal of Theoretical and Applied Statistics 2016; 5(1): pp. 1-4. Available at: https://scholar.google.com/scholar?hl=pt&as_sdl=0%2C5&q=sampling+methods+purposive&og=sampling+methods+p [Accessed 06 March 2020] Kellert, S. and Calabrese, E. 2015. The Practice of Biophilic Design. [Online]. Available at: http://www.xpuro.com/wp-content/uploads/2016/08/Biophilic-Design.pdf [Accessed 03 April 2020]. Marcus, CC. 2007. Healing Gardens in Hospitals. Interdisciplinary Design and Research e-Journal, pp. 1-27. [Online]. Available at: https://intogreen.nl/wp-content/uploads/2017/07/cooper_marcus.pdf [Accessed 03 April 2020]. Plooy-Cilliers F.D., Davis, C. and Bezuidenhout R.M. 2014. Research Matters. Claremont, CL: JUTA Ulrich, R. 1997. EFFECTS OF INTERIOR DESIGN ON WELLNESS. Journal of healthcare design: proceedings from the ... Symposium on Healthcare Design. Symposium on Healthcare Design February 1997, pp.97-109. [Online]. Available at: https://www.researchgate.net/publication/12761803_A_theory_of_supportive_design_for_healthcare_facilities [Accessed 04 April 2020]. Wiid, J & Diggins, C. 2013. Marketing research. 2nd edition, pp. 2013:186. Cited in: Plooy-Cilliers, FD, Davis, C and Bezuidenhout RM. 2014. Research Matters. Claremont, CL: JUTA			



28/7/2020

Student name: Edlasia Filipe

[REDACTED]

Campus: Vega, Pretoria

Re: Approval of BA Honours in Interior Design Proposal and Ethics Clearance

HONOURS/PGDIP ETHICAL CLEARANCE LETTER

Your research proposal and the ethical implications of your proposed research topic were reviewed by your supervisor and the campus research panel, a subcommittee of The Independent Institute of Education's Research and Postgraduate Studies Committee.

There are some aspects that you still need to address in your proposal. You will need to address these aspects in consultation with your supervisor before you may proceed (see below):

Please discuss with your supervisor/navigator/lecturer how you will address these issues listed below: Please note: **Your fieldwork (visual analysis) may proceed once you address the following issues:**

- You plan to do a visual analysis but mention participants in some places. Please take note of the following comments and concerns that your supervisor shared with you:
 - Certain concerns with regards to the methodology and data collection as pertaining to your research question and validity of study.
 - Alignment of the Approach and Paradigm to the method of data collection should be looked at and refined.
 - If you choose to have participants, please align all comments and content accordingly, and discuss with your supervisor first. You are not cleared to conduct interviews.
 - Sign your ethics checklist.

In the event of you deciding to change your research methodology in any way, kindly consult your supervisor to ensure all ethical considerations are adhered to and pose no risk to any participant or party involved. A revised ethical clearance letter will be issued.

We wish you all the best with your research!

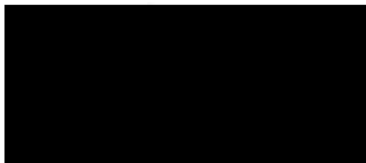
GENERAL CONDITIONS TO BE FULFILLED IN RELATION TO RESEARCH

Permission is granted to proceed with the above study subject to the conditions listed below being met and may be withdrawn should any of these conditions be flouted.

Please note: The panel has not considered the merits, accuracy or ethical soundness of the research. The only merits examined are the use of The IIE as a sample.

Permission is granted subject to the following conditions:

1. The researcher(s) will need to obtain informed consent in writing from all of the participants in his/ her sample if the study is not anonymous.
2. The researcher(s) may only use the data collected for research purposes and in no other way.
3. Photographs of human subjects may only be taken if relevant to the research, informed consent was obtained, and even with informed consent, the photographs may not be published on any online platforms.
4. The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.
5. No names or identifying information of participants may be used within the research and the research must be voluntary.
6. Please make it clear that the information will not be used punitively in any way and participants may in no way be counselled/advised based on this.



Campus Postgraduate Coordinator (CPC): **Ria van Zyl**