HUMAN-CENTRED THERAPEUTIC ENVIRONMENTS:

A NEW FRAMEWORK FOR BIOPHILIC DESIGN

Thesis Submitted in Accordance with the Requirements of the University of Liverpool for the Degree of Doctor in Philosophy

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ABSTRACT

The emergence of biophilic design as a discipline refers to the innate human connection to nature and natural processes to promote health and well-being in the spaces we inhabit. The principles that define biophilic design can be examined from three different perspectives: as established in building regulations and standards, as used in design practice and as investigated in research practice. When examining each of these areas, we can find several issues and disconnections. In practice and regulatory frameworks, we can observe the use of an unbounded design framework that is not underpinned by scientific facts, do not prioritise principles or parameters, and even considers as a design intervention the use of disparate evocations of nature that do not hold a meaningful sustained connection. In scientific academic environments, there is abundant research on many of the different aspects of biophilic design, but all of this in-depth research providing scientific facts about the importance of nature on humans has happened separately or for a specific design parameter, and not in a holistic way. Current biophilic design frameworks fail to provide efficient guidance, as their design recommendations do not differentiate the level of value of each design parameter for each building programme and context. My position is that a biophilic design framework can only be efficient if it is adapted to specific building functions and is geographically and culturally contextualised.

Likewise, the evolution of therapeutic architecture has mostly focused on managerial priorities (mass health working like a machine) and neglected the users' concerns. There is increasing research corroborating that the qualities of the setting in which a patient receives healthcare positively influence health outcomes. Therefore, it has become progressively important to review the concept of therapeutic environments, as places where users are supported in psychological, emotional and social terms. This quest for the optimal healing environment brings to the forefront the need to include other parameters in our design briefs, where the application of biophilic design proves to be paramount, as exposure to nature is associated with multiple health benefits.

This study assessed the application of biophilic design in therapeutic environments in the UK and provided a revised conceptual framework that can more efficiently guide designers and policy in future interventions. This framework was informed by synthesised analyses from the user's experiences, and the data obtained from semi-structured interviews with architects and managers, which was then benchmarked against scientific data about the impact of biophilic design on humans. This comprehensive approach helped to identify and rank those biophilic design parameters that appear the most critical for promoting and supporting health and wellbeing in healthcare settings and provided an up-to-date compilation of crucial design actions to enact the necessary change in future design practice.

Keywords: Biophilia Theory, Biophilic Design, Therapeutic Environment, Healthcare Design, Human-centred Design, Systematic Review, Meta-synthesis

To my beloved parents

For supporting me with great patience to reach my goals over the years

Firdevs and Hüsnü Tekin

DECLARATION

I certify that this thesis constitutes my own work/investigation, except where otherwise stated; other sources are acknowledged by explicit references.

I declare that this thesis describes original work that has not previously been presented for the award of any other degree of any institution.

Signed: Bekir Huseyin Tekin

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LIST OF ABBREVIATIONS AND SYMBOLS

SBS	Sick Building Syndrome
SAD	Seasonal Affective Disorder
WHO	World Health Organization
LBC	Living Building Challenge
ADHD	Attention Deficit Hyperactivity Disorder
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
LEED	Leadership in Energy and Environmental Design
IWBI	International WELL Building Institute
WELL	WELL Building Standard
SRT	Stress Recovery Theory
ART	Attention Restoration Theory
EBD	Evidence-based Design
PSD	Psychosocially Supportive Design
NPS	Net Promoter Score
HVAC	Heating, Ventilation, and Air Conditioning

CHAPTER 1

1. INTRODUCTION

The term “biophilia” has been increasingly used in the field of architecture. According to A *Dictionary of Psychology* (Colman, 2015), it stands for “love of life and living things” or “love of or empathy with the natural world”. Biophilia became popular in the 1980s, when the biophilia hypothesis was presented by Edward O. Wilson, who asserted that “the tendency of humans to focus on and to affiliate with nature and other life-forms has, in part, a genetic basis” (E. Wilson, 1984). As corroborated by numerous studies, in today's world we still very much need to be well-connected to nature for our well-being and health (Bodin & Hartig, 2003; Dopko et al., 2014; Hartig, 1993; Hartig et al., 1996; R. Kaplan, 1993; R. Kaplan & Kaplan, 1989; S. Kaplan, 1995; Ulrich, 1983, 1984, 1993; van den Berg et al., 2003).

While creating protected and controlled environments, we are designing our cities in a way that is harming our natural environment and moving us away from nature. Even though there is abundant research and practice prioritising design strategies that minimise the impact of buildings on natural resources through the development of sustainable architecture, it does not explicitly focus on reinforcing how to link us back to nature. The emergence of biophilic design as a discipline, therefore, aims to cover this shortcoming: biophilic design refers to the innate human connection to nature, and the natural processes to promote health and well-being in the spaces we inhabit (our built environment).

This is becoming more critical since the research conducted by the United Nations in 2018 confirmed that 55% of the world's population lives in urban areas. Moreover, according to the United Nations projections, this ratio will reach 68% in 2050 (United Nations, 2018). Today, the most urbanised regions are North America (82%), Latin America and the Caribbean (81%), Europe (74%) and Oceania (68%). The level of urbanisation in Asia is now approaching 50%. In contrast, 43% of the African population lives in cities (United Nations, 2018). Thus, in our rapidly urbanising and industrialising world, biophilia cannot be only seen as an aesthetic option but very much a great need for human beings (Allen et al., 2016). Furthermore, recent surveys show that we spend about 90% of our lives indoors (Ibid.). This increasing urbanised lifestyle brings some health problems due to the lack of natural elements in indoor spaces. For instance, Sick Building Syndrome (SBS), Seasonal Affective Disorder (SAD), or probably the most important one, a shortage of vitamin D, which is vital for human beings. At least a billion people worldwide are estimated to be vitamin D deficient (Holick, 2008), mainly in the northern hemisphere at latitudes higher than 40°N, because of inadequate exposure to sunlight (Spiro & Buttriss, 2014).

Thus, the goal of biophilic design in architecture is to promote health and high-quality wellbeing standards in habitats in which occupants find optimal psychological and physiological conditions, and their activities can develop emotional support. For instance, producing hospitals where patients will recover faster, schools where children will be more successful, offices where employees will be more productive, and housing where people are better acquainted with their neighbours and families, and live happier (S. Kellert et al., 2011). This need for a better connection between humans and the natural world has become a priority because of the rapidly increasing urbanisation of territories, and migration of the global population towards urban environments.

However, there is a debate on the universality of this innate preference for green/nature. In light of some research, nature does not have a considerable impact on a good way on everybody and can affect individuals in different ways. For instance, a study showed that nature can yield fear, and people respond to nature with varying levels of fear depending on their gender, sensitivity and lifestyle (van den Berg & ter Heijne, 2005). Furthermore, another study claims that not everyone actually likes nature due to people being used to relying on controlled and protected building environments to make us feel safer from the threat from nature (Bixler & Floyd, 2016). Despite the findings in these studies, the majority of the health and wellbeing literature demonstrates the importance and benefits of nature on us, as human beings. More importantly, findings from the background review in this study showed that this need to connect nature to the design of our spaces as a major vehicle for delivering high-quality well-being standards it is paramount in the case of healthcare environments.

Considerations about the quality of the environment in which healthcare is delivered can be tracked as early as ancient history. In Western culture, healthcare architecture evolved from the Asclepeions (healing temples) in Ancient Greece (Sternberg, 2009), to the military infirmaries in use during Roman times, Valetudinariums (Thompson & Goldin, 1975), and the hospitals run by the Church (monasteries) in Medieval and Renaissance times, which were later operated by town authorities during early Modernity (Verderber & Fine, 2000). These traditionally developed settings are early examples of biophilic thinking: they were usually built far from the high temperature, noise, dirt, and dust found in towns, and they typically offered a good view of nature and nearby freshwater sources. In the

18th century, hospitals started to diversify and specialize, producing medical research and training, and laying the foundations of modern hospital care. The first design principles for hospital wards developed by Florence Nightingale in her 1863 book Notes on Hospitals, were a crucial contribution towards establishing sanitation standards, which comprised considerations related to spatial layout, materials and colour, but most importantly to the quality of the environment, where natural elements such as daylight, fresh air ventilation, and heating played a key role (Nightingale, 1863; Verderber & Fine, 2000). From the time of this publication up to the Second World War, there was little literature on hospital design, however, soon after the war, the UK government started a proactive initiative for planning and post-design evaluation of this complex and costly building typology, as part of the new vision for the modern city (Kenny & Canter, 1979; Stone, 1976). Post-war hospital planning privileged the building's circulatory systems and mechanisation with the aim of increasing efficiency in the use of human and technical resources, rationalizing and accelerating the delivery of clinical care (reducing in-patient lengths of stay to the minimum clinically necessary, and through increases in day surgery and out-patient treatment) (Hughes, 1997). Nightingale's principles were progressively disregarded in this process, which together with the dramatic growth of urbanization, the advent of the germ theory and rapid changes in medical technology, led to an environmental approach to healthcare exclusively focused on healing through medical interventions (Murphy & Mansfield, 2017). From the mid-20th century to today's 'mega hospitals' (Verderber & Fine, 2000) , 'mall hospitals' (Sloane & Sloane, 2002), or 'factory-hospitals' (Jencks, 2017), healthcare environments have focused on the goals and objectives of the organisation (fast physical recovery, mass health working like a machine), while neglecting the users (staff, patients) concerns and aspirations, and with this, their emotional, mental and spiritual health (Abdelaal & Soebarto, 2019; Murphy & Mansfield, 2017; Silverstein, 2009). This is particularly important for patients who are diagnosed with cancer and are undergoing treatment, as many studies have confirmed that they may experience high levels of psychological discomfort, with many experiencing fatigue, anxiety or depression (Blazer et al., 1994; Guthrie, 1996; Mayou et al., 1991; McDaniel et al., 1995; Turner & Kelly, 2000; Zabora et al., 1997). There is research evidence that corroborates that the physical qualities of the setting in which a patient receives healthcare positively influence health outcomes in those mental disorders (Chrysikou, 2014; Evans, 2003; Galea et al., 2005; Laursen et al., 2014; T. H. M. Moore et al., 2018; Rao et al., 2007; Ulrich et al., 1991; Yadav et al., 2018).

In this context, it has become progressively important to review therapeutic environment design which should be a place that supports their users (staff, patients and their families), in psychological, emotional and social terms with the environmental conditions (Smith & Watkins, 2016; Ulrich et al., 2008). Since the 1950s, research has been increasingly investigating optimal healing environments (e.g., Stress Recovery Theory, Attention Restoration Theory, Therapeutic Environment Theory, Salutogenesis, and Supportive Design Theory), bringing to the forefront the need to include other parameters in our design briefs, where the role of nature, and with it, the application of biophilic design, proves to be paramount (e.g. Abdelaal & Soebarto, 2019; Blaschke, 2017; Blaschke et al., 2018; Chrysikou et al., 2020). However, studying the clinical side of healthcare architecture needs advanced expertise in medical sciences, and needs teamwork with researchers from various fields of expertise. Therefore, this thesis mainly focuses on therapeutic environments, and the outcomes represent a framework for non-clinical therapeutic environments, although studies from clinical applications of biophilic design were also investigated in order to have a broader insight into users' expectations.

1.1. Research Problem

The scoping review of the literature by the authors confirms that there are three areas in which biophilic design has been developed: as investigated in research institutions, as used in design practice, and as established in building standards. Examining each of these areas uncovers several issues and disconnections. In scientific academic environments, there is abundant research on many of the different parameters of biophilic design, but this research examining the effects of nature on humans has happened separately for specific aspects of the design parameters and has not been brought together in a holistic and coherent way to support the frameworks. The design recommendations provided by the existing frameworks, the WELL Building Standard and the Living Building Challenge (certification schemes created to support the nourishment of wellness in the built environment) (International Living Future Institute, 2019; International WELL Building Institute, 2020), are too broad and generic, and developed from a Western perspective. These biophilic design frameworks don't differentiate the level of value of each design parameter for each context, and therefore, as design instruments, are too vague. My position is that a biophilic design framework can only be efficient if it is specifically adapted to building function and geographical and cultural context. For instance, these frameworks recommend daylight as a parameter beneficial to humans, but don't specify adjustments regarding the daylighting requirements needed in a hospital of those needed in an educational building; or regarding the biological needs of people who live in extreme climates (e.g., northern latitudes or desert climates); or even regarding cultural dictates that might prioritize some parameters over biological needs (e.g., privacy over daylight in Muslim cultures). Therefore, to be able to provide efficient design guidance, it is necessary to determine a selective hierarchical structure for each context, as specific parameters from within the established general frameworks become especially relevant for the users.

With this in mind, Table 1-1 summarises detected problems in biophilic design practice, regulations, and research throughout an extensive background review. Therefore, a collective problem from these three perspectives emerged as: *There is no holistic scientific framework which defines borders and definitions of biophilic design that specialised for different building typologies and guides designers through a clear path.*

Table 1-1: Detected problems in biophilic design practice, regulations and research.

Perspective	Problem
Regulations	• Current standards do not specialise in biophilic design, and do not indicate biophilic designs but use biophilic values as criteria among the many other non-biophilic features. • Employs no holistic compulsory conditions related to biophilic design.
Research	• Definitions and borders of biophilic design have changeable and debatable means. • Although nature and natural elements' benefits have been examined, no compiled guideline defines frames for biophilic design specific to building function, cultural and geographical context.
Practice	• Current frameworks are not efficient as they are not adapted to specific building functions, and are not geographically and culturally contextualised. • Many existing 'biophilic' buildings show a lack of deep understanding in the use of biophilic theory, due to the broad definitions of biophilic parameters, which have not been hierarchised to guide designers to design with a higher level of accuracy. Thus, there are buildings that have been claimed as biophilic designs for commercial purposes, many of which are not close to present biophilic qualities.

No doubt that examining all the building typologies with such a level of detail is a huge endeavour that cannot be undertaken within the timeframe of a PhD study. Therefore, this research focused on a particular building typology to narrow the field down to a reasonable extent. Since healthcare provision has mostly focused on managerial priorities and neglected the users' concerns, thus, improving the current state of healthcare design and its environmental quality is a momentous need. So, it has become progressively important to review the concept of therapeutic environments, as places where patients are treated with the most advanced medicine and technology, but also support their users in psychological, emotional and social terms. Especially in relation to the latter, non-clinical healthcare environments have taken a prominent position in providing this support to patients, above all those who suffer distressful diseases such as cancer.

1.2. Research Aim, Question and Objectives

In light of the research problems above explained, the main goal of this research study is the redefinition of a scientifically underpinned biophilic design framework, with a particular focus on non-clinical therapeutic environments. This research also aims to hierarchise the parameters included in the new framework in a way that can more efficiently guide designers, revealing which are the most critical for promoting and supporting human health and wellbeing in these environments. Hence, to reach these research aims, the following research question emerged to be answered in this research:

> *Which biophilic parameters are critical in the design of a non-clinical therapeutic environment, and how can designers implement them adequately in their designs within the limits of a holistic scientific and regulatory framework?*

On the way of answering the research questions, this research aims to achieve the following theoretical, methodological and practical objectives:

1] Study the biophilic design discipline as investigated in research practice, as used in design practice, and as established in regulations and standards to understand the needs for biophilic restoration.

2] Explore the benefits of connecting with nature and natural elements based on scientific facts.

3] Study the theoretical premises and approaches that support physiological, psychological, and emotional health in therapeutic environments.

4] Examine and analyse existing literature and scientific facts systematically to compile scientific evidence for answering the research question, using systematically searched review and meta-synthesis methodologies to achieve the most accurate and less biased compilation of data.

5] Carry out semi-structured interviews with experts and practices to support and enrich scientific evidence with experience and practice-based knowledge.

6] Hierarchise biophilic design parameters based on importance and demand level in therapeutic environments in the context of the UK.

7] Introduce qualitative and quantitative findings from primary and secondary sources and reveal recommendations to inform design practice.

8] Propose a design framework that will guide designers to implement biophilic design adequately in their buildings.

9] Recommend practical, research, design and methodological future implications based on findings, results and interpretations.

In order to reach these objectives different methodological approaches have been used in this research. Although the methodological steps are explained in the chapters in detail, the following section gives an overview of the methodology.

1.3. General Methodology

The methodological approach included data collection from two different sources: 1] Scientific evidence, and 2] Professional practice and experience. A narrative literature review, systematically searched literature review, and meta-synthesis informed the scientific evidence with secondary sources, while professional practice and experience were investigated with primary data collected from the semi-structured interviews. As illustrated in Figure 1-1, methodological steps evolved as follows:

1] A grey literature review: to get an insight into the demands of patients and required environmental features of healthcare settings from reports. The grey literature review contributed to the research by revealing keywords and practical questions that were used in the interviews.

2] A narrative literature review: to support scientific evidence in terms of the biophilic design discipline as investigated in research practice, as used in design practice, as established in regulations and standards, and in healing environment and relevant theories; to explore the benefits of connecting with nature and natural elements with scientific facts; to trace the evolution of healthcare environment design through historical background, and establish a conceptual foundation of common therapeutic building typologies by signifying spatial characteristics and user groups; and to study the theoretical premises and approaches that support physiological, psychological, and emotional health in therapeutic environments.

3] A systematically searched review: to provide scientifically reliable and less-biased insight into the importance of the biophilic design elements in clinical environments from peer-reviewed journal papers. The systematically searched review followed rigorous replicable peer-reviewed steps: a review question; a systematic search strategy consisting of searching keywords, searching syntaxes based on the selected databases, and a set of inclusion and exclusion criteria; screening and selection of literature; data extraction and quality assessment. The systematically identified nine studies helped to identify and rank the biophilic design parameters that appear the most critical for promoting and supporting human health and well-being in clinical therapeutic environments, from the users' perspective. Although the main focus of this research is non-clinical environments, this study provided users' needs and perspectives which can be adaptable to their non-clinical environments. It also provided an up-to-date compilation of crucial design interventions related to biophilic parameters and as such provides benchmark information for future research and design guidance in these environments.

4] A meta-synthesis: to identify, compare and synthesize all the published qualitative literature on Maggie's Centres, as non-clinical settings, systematically. This methodology aimed to investigate Maggie's Centres' architecture, well known for their carefully designed buildings and gardens to provide bespoke healing environments, from the users' and the designers' perspectives, assessing their experiences in these buildings and their design intentions. There have been previous qualitative research on these centres which included interviews, focus groups, observations and questionnaires but were conducted from different standpoints (e.g. Annemans et al., 2012; Birch et al., 2014; Martin et al., 2019; van der Linden et al., 2015). Thus, while a great amount of qualitative data exists within the published body of research, it has not been analysed through a biophilic lens. This research aimed to review and integrate this body of research using a meta-synthesis methodology. Particularly, direct quotations of users and architects, obtained via interviews and focus groups, may be considered primary data as it has not been analysed with this research intention before. The analytic process included a systematic search strategy, data extraction and classification of salient concepts using an open-coding approach, and lastly an interpretive evaluation. The systematically selected data helped to identify and rank the biophilic design parameters that appear the most critical for promoting and supporting human health and well-being in non-clinical therapeutic environments, from the users' perspective. It also offered a compilation of distinctive design interventions related to biophilic parameters, which provides benchmark information for future research and design guidance in non-clinical therapeutic environments.

5] Semi-structured interviews with experts and practices: to enable the collection of a set of information from practice and support and enrich scientific evidence with experience-based knowledge, verify the results obtained from a systematically searched review and meta-synthesis studies by crosschecking the results from primary sources, and support and expand the results based on recommendations of the experts. The interview population consisted of therapeutic environment experts: a psychologist, and five architects. Architect participants were invited among the architects of Maggie's Centres who were also involved in the design of clinical settings or hospitals. The research reached saturation with five architects who designed the centres that have various key features that the study wanted to contrast: urban versus rural settings; use of low-key resources versus non-restricted design; employed special materials, gender-friendly explorations, as well as presenting a variety of early period centres and recently designed centres.

Eventually, the biophilic design guidelines for therapeutic environments with a conceptual framework were created by analysing and synthesising the data obtained from the systematically searched review, the meta-synthesis, the interviews, and the narrative literature review, in which design recommendations for biophilic design applications and a hierarchised provision of biophilic design parameters can be found based on spatial requirements and user groups' preferences.

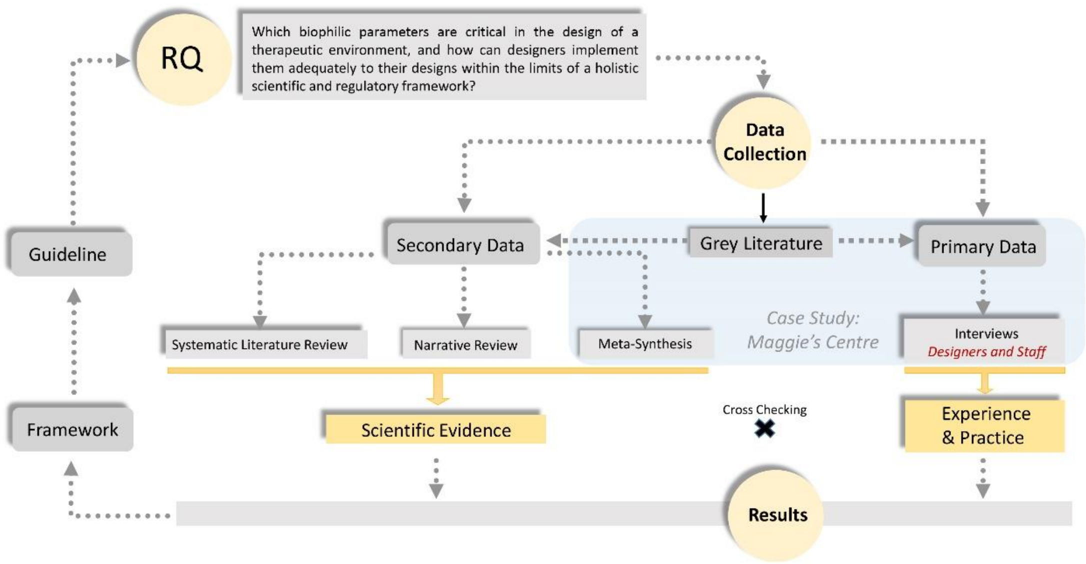


Figure 1-1: Methodological process.

1.4. Outline of Thesis

Following this introductory chapter, the thesis is presented according to the following briefly outlined chapters:

Chapter 1 introduces the research by defining general background information, research problem, research aim, research question, research objectives, general methodology and outline of the thesis.

Chapter 2 describes the notion of biophilia and biophilic design discipline as investigated in research practice, as used in design practice, and as established in regulations and standards, and examines the benefits of connecting with nature and natural elements using scientific facts.

Chapter 3 briefly traces the evolution of healthcare environment design through history, and establishes a conceptual foundation of common therapeutic building typologies by signifying spatial characteristics, outlining theoretical premises and approaches that support physiological, psychological, and emotional health in therapeutic environments.

Chapter 4 reports the systematically searched review study that provided scientifically reliable and less-biased insight into the importance of the biophilic design elements in clinical environments from peer-reviewed journal papers, with methodological steps, protocol, data extraction, analysis, synthesis and quality assessment.

Chapter 5 reports the meta-synthesis analysis that identified, compared and synthesized all the published qualitative literature on Maggie's Centres, which included a systematic search strategy, extraction and classification of salient concepts using an open-coding approach, and lastly an interpretive evaluation for non-clinical environment design.

Chapter 6 analyses the semi-structured interviews with experts and practices, which enabled the collection of a set of information from practice and to support and enrich scientific evidence with experience-based knowledge, informing the biophilic design process, decision making, and recommendations to design practice for both clinical and non-clinical settings.

Chapter 7 introduces the biophilic design guidelines for therapeutic environments with a conceptual framework, created by analysing and synthesising the data obtained from the systematically searched review, the meta-synthesis, the interviews, and the narrative literature review, and ultimately summarises design recommendations for biophilic design applications.

Chapter 8 presents the conclusions drawn from the research, and conveys practical, research, design and methodological recommendations for future implications based on the findings, results and interpretations.

CHAPTER 2

2. BIOPHILIA AND BIOPHILIC DESIGN: RESEARCH, PRACTICE, AND STANDARDS

A Dictionary of Psychology explains that the term ‘biophilia’ etymologically comes from the ancient Greek words ‘bios-’ meaning ‘life’, and ‘-philos’, meaning ‘friendly feeling toward’ (Colman, 2015) . Biophilia is defined at its most straightforward meaning as the love of life (E. Wilson, 1984). The term may be a relatively new one, but the concept is not. Therefore, people have been intuitively aware of it since ancient times, when natural objects, shapes, and patterns have often acted as a source of inspiration for architects all over history.

The concept of biophilia can be traced back in written literature to the times of Aristotle, although its popularisation started in the second half of the 20th century (Santas, 2014). The psychologist Erich Fromm, first used the term biophilia in his book *The Heart of Man* in 1964. He defined biophilia as a “tendency to preserve life and to fight against death” (Fromm, 1964). In his *The Anatomy of Human Destructiveness* book of 1973, Fromm also explained biophilia as “the passionate love of life and of all that is alive”, and “the wish to further growth, whether in a person, a plant, an idea, or a social group” (Fromm, 1973).

Although the term was coined by Fromm in modern literature, it was popularised by Edward O. Wilson. Professedly, Wilson never associated his work with Fromm, but he used the term “biophilia” and developed it a few years later in socio-biology. Wilson’s first mention of the concept was in *The New York Times Book Review* in 1979, an article titled *Biophilia*, which served as an advertisement for Harvard University Press with the headline: *Capital Ideas from People Who Publish with Harvard*. The ‘capital’ idea expressed in this article was (E. O. Wilson, 1979):

> *Our deepest needs stem from ancient and still poorly understood biological adaptations. Among them is biophilia, the rich, natural pleasure that comes from being surrounded by living organisms, not just other human beings but a diversity of plants and animals that live in gardens and woodlots, in zoos, around the home, and in the wilderness.*

Wilson started to define biophilia as “the innate tendency to focus on life and lifelike processes” in his book titled *Biophilia* (E. Wilson, 1984). Nine years after this book, in 1993, he wrote another book, *The Biophilia Hypothesis* together with Stephen R. Kellert. Biophilia was defined once again in this book as “the innately emotional affiliation of human beings to other living organisms" (S. Kellert & Wilson, 1993). Fromm's study was focused on human health, and his definitions for other parts of nature remained incomplete. However, Wilson and Kellert focused primarily on the improvement of natural factors and on sustaining biodiversity, considering the relationship between nature and human beings, thus improving human health. Hereafter, Stephen R. Kellert explored biophilia as a design tool, developing a new approach to architectural design.

2.1. Biophilic Design

> *Biophilic design is the deliberate attempt to translate an understanding of the inherent human affinity to affiliate with natural systems and processes—known as biophilia—into the design of the built environment* (S. Kellert et al., 2011).

The emergence of biophilic design as a discipline refers to the innate human connection to nature and natural processes to promote health and well-being in the spaces we inhabit (S. Kellert et al., 2011; S. Kellert & Calabrese, 2015; S. Kellert & Wilson, 1993). After the Industrial Revolution, urbanisation started to increase rapidly and is still increasing. People spend most of their time in places that are far from their natural context. At this point, the emergence of biophilic design, inspired by biophilia, aimed to strengthen the relationship between the modern building stock and nature, and ensure that people live within natural conditions in order to promote their wellbeing and health.

The term 'biophilic design' was introduced in 2004 by authors of different disciplines participating in a symposium named *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life* (W. Browning et al., 2014; Ojamaa, 2015). A book, with the same name, compiling all the papers presented in the symposium was published in 2008, in which biophilic design was defined as an approach to designing the built environment in a way that emphasises the necessity of "maintaining, enhancing, and restoring the beneficial experience of nature" and is "the deliberate attempt to translate this understanding of the inherent human affinity to affiliate with natural systems and processes in the built environment" (S. Kellert et al., 2011). Thomas Heatherwick, a multi-award winning British architect, explained the biophilic design concept in the *Foreword* of *Nature Inside: A Biophilic Design Guideline*, published by RIBA in 2020, claiming that there was a misunderstanding of biophilia which had been commonly assumed as just pretentiously and over-complicatedly expressed way to say the inclusion of plants are good, but in the true definition of biophilic design, it is actually "the science of our emotional responses to the world" (W. D. Browning & Ryan, 2020).

Another misunderstanding about biophilic design theory is that it is commonly confused with sustainable design. Biophilic design shares some principles with sustainable design but is not the same concept. In short word, sustainable design focuses on the environmental impact of buildings and on mitigating these impacts, while biophilic design focuses on the impact of nature on the physical environment and combining natural elements for the benefit of human health and well-being (Molthrop, 2011).

Biophilia has been defined in many different ways over decades to different extents. For example, apart from the earliest definitions stated above, Salingaros defined human ambition for natural daylight as photophilia, and for natural environments (colour, gravity, fractals, curves, detail, water, life) as topophilia, while classifying all these physiological responses under the term 'biophilia' (Mehaffy & Salingaros, 2017; Salingaros, 2015).

Biophilic design has been defined by the pioneers of the field as explained above. However, my position is that the current definitions are not efficient enough in the support of design practice. Biophilic design is not just about listing all the parameters that can put us in close proximity with nature, or about examining how to design with natural elements individually. Equally, the inclusion of natural elements per se is not exclusive to biophilic design. Even though daylight or fresh air are natural parameters, designers have always been aware of the need to include them adequately to create a healthy and comfortable space, and the prescription and regulation of these parameters form part of every design guideline. My view is that biophilic design can only be fully achieved if the relevant parameters for the targeted user groups work together harmoniously in the space. For example, a picture of nature on a wall or a bright room without a view cannot be defined as biophilic. Likewise, designing a garden from a biophilic perspective cannot just be for providing oxygen, but also for enabling a full experience in connection with nature, including a multi-sensory immersing scenario working in synergy: with elements such as plants, smells, freshness, animals, colour, sounds, water or textures but also feelings of mystery, prospect, refuge or even danger. This is what biophilia is about, feeling the connection with nature in that complex and intricate relationship between different parameters. The idealogy that Kellers, Browning or Salingaros presented did not explain clearly how that connection happens. Moreover, not all parameters are equally important for every type of building, this harmony should be established for each building typology and attending to climate and local culture, since people have different notions and perceptions of nature. Biophilic design frameworks should be focused on building programme, user profile, and context.

Although the biophilic design concept is considered a new discipline, many researchers have examined the human-nature relationship for many years, and its positive impact was proven by a wide range of perspectives. The following section presents the benefits of connecting with nature and investigated natural parameters that were supported more frequently by empirical data (based on research of Browning et al. (2014)) : light, greenery, water, fresh air, thermal variability, natural materials, colour, and experiences of nature such as prospect, refuge, curiosity.

2.1.1. Research: Benefits of Connecting with Nature

Along with the knowledge that natural settings offer the most preferred environments (Hartig, 1993; R. Kaplan & Kaplan, 1989; Ulrich, 1983; van den Berg et al., 2003), a rich body of research proved that engagement with nature and natural processes impacts human health and wellbeing both psychologically and physiologically. Research on nature's impacts became popular after the 1980s. In 1981, Ernest Moore of the University of Michigan experimented with the South Michigan State Prison, where half of the prisoners were held in rooms with windows leading to fields and trees, while others were held in rooms facing the enclosed courtyard. It was found that prisoners in the rooms facing a courtyard visited the doctor 24 per cent more compared to prisoners with a natural view (E. O. Moore, 1981). Another pioneering study was carried out by Roger Ulrich in the 200-bed Pennsylvania hospital. Some of the rooms had a view of woodland and greenery, while the other rooms were facing the brown brick walls of the next building. Ulrich investigated the length of hospital stay, patients' records for pain and anxiety medications, frequency of minor medical complications along with the notes of nurses for the last ten years. The result revealed that patients with natural views had statistically shorter hospital stays (7.96 days compared to 8.70 days), less need for pain and anxiety medication, and less harmful interpretations in nurses' notes compared to patients with brick wall views (Ulrich, 1984).

Subsequent research revealed many other benefits of contact with nature. In general, contact with nature has been shown to promote emotional, mental and spiritual health, reducing stress and triggering positive shifts in mood, and a sense of belonging (Abdelaal & Soebarto, 2019; Berman et al., 2008; W. Browning et al., 2014; Gillis & Gatersleben, 2015; S. Kellert et al., 2011; Murphy & Mansfield, 2017; Purani & Kumar, 2018; Rosenbaum et al., 2018; Silverstein, 2009). The most noticeable benefits revealed that contact with nature restores attentional fatigue (Bodin & Hartig, 2003; S. Kaplan, 1995; Korpela et al., 2017), fosters recovery, and reduces stress levels (Beute & de Kort, 2014; W. Browning et al., 2014; Cordoza et al., 2018; Duzenli et al., 2017; Hartig et al., 2003; Joye & Dewitte, 2018; R.

Kaplan & Kaplan, 1989; Marcus et al., 1995; B.-J. Park et al., 2007; Ryan et al., 2014; Ulrich, 1993, 2002; Ulrich et al., 1991, 2008; M. White et al., 2010; Zijlstra et al., 2017). Therefore, it implicitly helps to recover from the problems caused by stress. Stress level impacts mental stress state and promotes negative emotions (Brosschot et al., 2005), and it can increase the risk for particular illnesses such as cardiovascular diseases, arthritis, and diabetes, or worsen them (Cohen et al., 2012). Stress might have an impact on brain lobs which can even cause degrading memory (Sauro et al., 2009), and can affect cognitive performance by boosting negative emotions (Ellenbogen et al., 2002). Furthermore, some studies have claimed that a natural view not only helps relieve stress but also can immunise people against stress if a person is exposed to natural views before confronting a trigger of stress (Parsons et al., 1998), because exposure to a natural view ten minutes before experiencing a mental stressor affects parasympathetic activity and heart rate (Barton & Pretty, 2010). In addition to coping with stress, a controlled safe nature can reduce negativity on mood while boosting positive mood (Berman et al., 2008; Hartig et al., 2003; Ulrich et al., 1991), and direct experience with natural settings stimulates sensory perception and relaxing feelings (Kjellgren & Buhrkall, 2010), a sense of pleasure and calm (Maller et al., 2006), and positive emotions (Berman et al., 2008; Gillis & Gatersleben, 2015; Murphy & Mansfield, 2017). Positive emotions are overall beneficial to health (Pressman & Cohen, 2005) and buffer the potential harms of stress (B. L. Fredrickson & Joiner, 2002).

Additionally, studies have proved that natural engagement lessens physiological arousal and decreases heart rate (Laumann et al., 2003), accelerates cardiovascular recovery (B. L. Fredrickson & Levenson, 2010), helps relax muscles (B.-J. Park et al., 2007) and regulation of digesting activities (Brown et al., 2013), reduces blood pressure, tension, anxiety, fatigue (Abdelaal & Soebarto, 2019; Barton & Pretty, 2010; Berman et al., 2008; Hartig et al., 1991, 2003; Murphy & Mansfield, 2017; B.-J. Park et al., 2007; Silverstein, 2009), increases spiritual health, positive thoughts, coping ability (Marcus et al., 1995; Murphy & Mansfield, 2017), and creates a sense of tranquillity (Hunter et al., 2010; Pheasant et al., 2010). Views of nature through windows were associated with decreasing the time of hospital stay after surgery, reduced Sick Building Syndrome (SBS) and anxiety, and improved performance at a task (Heschong & Mahone, 2003; S. R. Kellert, 2005; Loftness & Snyder, 2008; Mendell, 1991; Ulrich, 1984). Furthermore, natural elements increase cognitive functionality and performance, productivity, and concentration (S. Kaplan, 1995; Larsen et al., 2016; Shoemaker et al., 1992; Thomsen et al., 2011), and restorative to pay attention (Berto, 2005; Bodin & Hartig, 2003; Lee et al., 2015). The benefits of nature were also demonstrated in the studies on children with Attention Deficit Hyperactivity Disorder

(ADHD), since nature helped to enhance their concentration (Faber Taylor & Kuo, 2009, 2011).

It has been attested that physical exercise in nature is more beneficial than urban environment (Thompson Coon et al., 2011), and surprisingly, exposure to nature makes people physically more active (Ward Thompson & Aspinall, 2011). Ellett et al. (2008) found that walking in a bustle urbanised environment enhances mental health problems of adults with poor mental health, whereas nature walks to increase positive mood and mindset(Roe & Aspinall, 2011). In the study of Bodin & Hartig (2003), 12 runners went on two routes each, one through a nature reserve featuring a pine-birch forest and open fields, the other along sidewalks and streets in an area of mid-rise apartment houses and commercial developments. The runners rated their emotions after each of the runs, in the categories of revitalisation, tranquillity, anxiety/depression, and anger, permitting a comparison of the two environments. The results were in favour of the natural setting (Bodin & Hartig, 2003). The first five minutes of nature experience are the most impactful period on positive mood and self-esteem (Barton & Pretty, 2010).

In addition, the social impacts of nature were measured at Chicago's Robert Taylor Homes. These 28 identical blocks had the opportunity to measure biophilic design effect, because of both busy unnatural highway and railway views from one side, and full of tree and grassland natural views on the other side. The results were striking: nearby trees are associated with higher levels of attention and self-discipline, less violence and other aggressive behaviours, lower crime rates, and better interpersonal relations (Kuo, 2016; Kuo & Sullivan, 2016a, 2016b)

Some studies also compared nature with different characteristics. For example, an ordinary plain view of autumn fall was detected as less restorative than a more complex natural landscape that includes water elements (Felsten, 2009). Compared to a real natural view, images of nature were less stress-reducing yet effective in certain spaces, such as clinics (Blaschke et al., 2016; Kjellgren & Buhrkall, 2010). For example, Kahn et al. (2009) found that heart rate recovery from low-level stress was 1.6 times faster with a real natural view through a glass window than a technological natural view stimulation on a screen. Also, real views still attract people's attention and interest over time whereas artificial view diminishes the level of interest (Biederman & Vessel, 2006).

However, it should be taken into account that nature, as a multisensory environment, does not consist of only visual characteristics but also auditory, olfactory, haptic and gustatory features. For example, research showed that natural sounds increase motivation and decrease fatigue (Jahncke et al., 2011), help recovery from stress 37 per cent faster

(Alvarsson et al., 2010); aromatherapy with natural fragrances has a positive impact on immunity and particularly on healing process (J. T. Kim et al., 2007; Q. Li et al., 2012); horticulture activities where people involved in gardening, along with the physical benefits, decreases fatigue (Kam & Siu, 2010; Millet, 2009; Yamane et al., 2004), touching real plants rather than artificial leaves creates a feeling of relaxation by changing blood flow rate (Koga & Iwasaki, 2013). Furthermore, animal therapy in which the main focus is companionship and petting reduces stress and anxiety with a calming impact (Ambrosi et al., 2019; Folse et al., 1994; Souter & Miller, 2007). However, people only like a moderate multisensory environment, and overstimulation should be avoided, whereas lack of sensory richness can create a boring environment that makes dwellers more passive (J. Heerwagen, 2006).

Apart from all the benefits, scientific research also suggested that the notion of 'nature is beneficial' is not right for everyone on an equal level. For example, although a natural connection creates a sense of belonging, consideration of natural elements' benefits should be assessed within specific cultural and ecological contexts, since cultural and ecological attachment to an environment has been found highly restorative (Devine-Wright & Howes, 2010). Moreover, a study stated that not everyone actually likes nature because people have been used to relying on controlled and protected building environments to feel safer from threats from nature (Bixler & Floyd, 2016). With this in mind, the gender of individuals can also affect their perception of nature. van den Berg & ter Heijne (2005) revealed that male individuals' responses to nature and natural threats are more positive than female individuals, or sensation seekers respond more positively than non-seekers. Furthermore, another study showed that natural images reduced stress and anger levels significantly in male participants while the impact was not significant in female participants (Kweon et al., 2007). On the contrary, plants helped to improve the performance of female participants, unlike male participants in Shibata & Suzuki (2004).

The following sections examine the psychologic, physiologic, and cognitive benefits of particular natural elements and biophilic design parameters separately.

2.1.1.1. Light

Having looked at the natural elements separately, the impact of light has been the most frequently studied element, undoubtedly. It is commonly known that sunlight is essential for human health and well-being. Sunlight exposure duration is also a vital issue because lack of sunlight causes health problems such as vitamin D deficiency, rickets, SAD, sadness, anxiety, alcohol addictions, irritability, suicide, decreased appetite, hypersomnia, lethargy, carbohydrate craving and so on, whereas overexposure can also cause health problems such as skin cancer (Beute & de Kort, 2014; Nabil & Mardaljevic, 2006; Rosenthal et al., 1984).

Overall, natural light has been found beneficial for psychologic and physiologic health and wellbeing (P. R. Boyce, 2010; W. Browning et al., 2014; Gillis & Gatersleben, 2015; Husein & Salim, 2020; S. Kellert et al., 2011; Küller & Lindsten, 1992), as it reduces negative mood, fatigue, stress, heart and pulse rates, relieves pain after surgery, enhances positive mood and joy of living, helps to overcome depressive mood, and positively affects chemotherapy receivers (Denissen et al., 2008; Leppämäki et al., 2002; Lieverse et al., 2011; Liu et al., 2005; Marberry, 1995; Partonen & Lönnqvist, 2000; Walch et al., 2005). Sunbathing supports overcoming mild hypertension (Krause et al., 1999), and impacts cortisol production (Leproult et al., 2001). Daylight regulates the biological clock and circadian rhythm that provide better sleep quality (M. Figueiro et al., 2011; M. G. Figueiro & Rea, 2014; Hubalek et al., 2010; Kandel et al., 2013; Lieverse et al., 2011; Riemersma-van Der Lek et al., 2008; Smolders et al., 2013), while disruption in circadian rhythm can cause some health risks including cancer, obesity, diabetes and heart diseases (van Cauter et al., 2008). Furthermore, many studies proved that inpatients who receive better daylight (approx. 300 lux, as recommended by Illuminating Engineering Society of North America (2020) for hospital rooms) have a shorter length of stay (Beauchemin & Hays, 1996; Benedetti et al., 2001; Choi et al., 2012; A. Joarder et al., 2009; A. R. Joarder, 2011; M. Y. Park et al., 2018; Salonen et al., 2014; Walch et al., 2005), however, Beauchemin & Hays (1998) found that women were affected from sunlight exposure more than men since women's overall length of stay was reportedly shorter. Another research surprisingly claimed that daylight only shortened the length of stay for illiterate patients (X. Li et al., 2022).

Despite this, the studies relevant to intensive care units have not found a clear result. For example, Beauchemin & Hays (1998) claimed that the mortality rate is lower in bright cardiac intensive care units, while Simons et al. (2014) have not detected any impact of sunlight exposure in the development of intensive care unit acquired delirium, or Wunsch et al. (2011) found that presence of daylight and window in intensive care units did not show any improvement on the investigated patients who were critically ill with bleeding in the space that surrounds the brain. Undoubtedly, further investigations are required to have a better understanding of daylight's impact in intensive care units concerning different illnesses.

As one of the main triggers of many psychologic problems, Seasonal Affective Disorder (SAD) can be diminished by sunlight exposure (Avery et al., 2001), and daily outdoor walking during sunny times decreases SAD symptoms (Wirz-Justice et al., 1996).

Moreover, it is widely known that daylight is one of the main factors that activate and synthesises Vitamin D which is vital for human being as it provides protection from many diseases including cancer, influenza, cardiovascular diseases, depression, diabetes, etc. (Kauffman, 2009). Vitamin D deficiency might even cause schizophrenia (Chiang et al., 2016; Cui et al., 2021). Vitamin D also promotes serotonin production that increases happiness and positive mood (Lambert et al., 2002; Lansdowne & Provost, 1998). However, change in mood depends on many other parameters such as personality, age, seasons, and time (Denissen et al., 2008), thus, Kaida et al. (2007) claimed that 30 minutes of exposure to sunlight (approx. 3000 lux) improved the mood positively. Specifically, artificial light should be considered more rigorously with caution. Some psychological and physiological problems like eye pressure, headaches depression, and fatigue can emerge as a result of over-exposure to artificial light (Husein & Salim, 2020). Lighting design is also an important parameter whether it is daylight or artificial light. Light as a biophilic design element can be examined in various states of its design and existence within the space, although the most straightforward meaning is the direct inclusion of natural light and its full-colour spectrum. Filtered and diffused light, particularly by mitigating the effects of glare, can improve the benefits of light as well as encourage feelings of connectedness by establishing a variable and mediated connection between spaces. Moreover, reflected light which also enhances the penetration of light into interior spaces can promote the mitigation of glare (S. Kellert et al., 2011). A complementary contrast of light and shadow can promote momentous satisfaction of the space, and a creative harmony of light and shadow can evoke curiosity, mystery, and a feeling of refuge (S. Kellert et al., 2011). Furthermore, warm light can increase the feeling of security. Kellert also stated that creating stimulating, dynamic and sculptural forms by manipulating natural light facilitates mobility, curiosity, imagination, exploration, and discovery. In short, diffuse lighting provides a feeling of calmness, while accent lighting creates curiosity and interest, task lighting gives flexibility in intensity and focus and, dynamic light and shadows attract attention (W. Browning et al., 2014).

Additionally, in modern medicine, bright light therapy is used to heal major depressive disorder, dementia, premenstrual dysphoric disorder, Parkinson's disease, and bulimia nervosa (Leppämäki et al., 2002; Lieverse et al., 2011; Wirz-Justice et al., 2009).

Daylight also impacts cognitive performance and promotes productivity and concentration (P. Boyce et al., 2003; Brotas et al., 2013; de Giuli et al., 2008; Heschong &

Mahone, 2003). Zadeh et al. (2014) claimed that the presence of windows and natural light in healthcare settings improved the communication and performance of nurses. Exposure to daylight three hours a day increased job satisfaction and decreased work-related stress in a hospital environment (Alimoglu & Donmez, 2005).

Another important example of the cognitive and physiologic impact of light by Nicklas et al. (1996) investigated the effect of full-spectrum light on students. The students in full-spectrum light were healthier and they attended school 3.2 to 3.8 days more per year than those in usual classrooms. Libraries with superior daylight resulted in significantly lower noise levels. Full-spectrum lighting induced more positive moods in students, and due to the additional vitamin D dental caries were nine times less, and they biennially grew an average of 2.1 cm more than students attending average-lit schools. Moreover, the students who attended daylit schools out-performed the students who were attending non-daylit schools by 5 to 14 per cent.

2.1.1.2. Greenery

As one of the well-known parameters of biophilic design, the impacts of engagement with greenery and plants were broadly investigated by many researchers. The presence of plants has been found effective on physiological health, in particular impact on the reduction of stress, anxiety, fatigue, and lessening pain, heart rate, and blood pressure (Barton & Pretty, 2010; Bodin & Hartig, 2003; Bringslimark et al., 2009; Dijkstra et al., 2008; Küller & Lindsten, 1992; Larsen et al., 2016; Marcus & Barnes, 1999; Orsega-Smith et al., 2017; Pheasant et al., 2010; Thomsen et al., 2011; Ulrich et al., 2020), thus, a presence of plants also psychologically supports patients to response treatment (Matsunaga et al., 2011; S. H. Park & Mattson, 2009). The studies reported that both individual cases and communities that live with a higher percentage of green space (from single space to urban context) have better health conditions in general (Maas et al., 2006; Ward Thompson et al., 2012). Furthermore, it was found that the presence of plants in a workplace context increases productivity (Nieuwenhuis et al., 2014), while Larsen et al., (2016) claimed that the high density of plants, on the other hand, decreases productivity despite offering higher positive impact. A moderate level of plants, therefore, is more efficient in a working environment to create balance. Additionally,Qin et al. (2013) claimed that slightly scented plants with green and small leaves are the most appropriate and effective plants for health and wellbeing, whereas red flowers are fatiguing impact over time.

Green roofs have also been studied extensively, Lee et al. (2015) found viewing green roofs have a micro-restorative impact on attention even after only 40 seconds. On the other hand, another study claimed that commonly used 'sedum' vegetation has scarcely more impactful than bare roofs, thus, the type of vegetation and landscape design is critical to providing the restorative potential to the green roofs (E. v. White & Gatersleben, 2011).

S. Kellert & Calabrese (2015) stated that one of the most effective ways of bringing the direct experience of nature into the built environment is to use vegetation, particularly flowering plants. The general concept of biophilia claims that the application of single or isolated plants is not effectively beneficial. Vegetation should be rich and ecologically connected while the plants should be chosen from local species (S. Kellert et al., 2011).

2.1.1.3. Water

When people were asked about their ideal therapeutic environment they pictured an environment with water elements, thus, water is undoubtedly one of the most preferred elements in a therapeutic environment (J. H. Heerwagen & Orians, 1995; R. Kaplan & Kaplan, 1989; Völker & Kistemann, 2011; M. White et al., 2010). Water elements, from small fountains to oceans, have restorative and stress recovery impact on human beings with visual, auditory and tactile features (Alvarsson et al., 2010; W. Browning et al., 2014; S. Kellert et al., 2011; Pheasant et al., 2010; Ulrich et al., 1991). Some researchers even claimed that water scenes in an urban environment have an equal restorative impact with solely natural waterless scenes (Jahncke et al., 2011; Karmanov & Hamel, 2008). Also, Barton & Pretty, (2010) suggested that the presence of water encourages self-esteem and positive mood more than green spaces. However, the restorative effect of the water depends on its quality, supporting evidence suggested that dirty and brown water are less restorative than clear water (J. H. Heerwagen & Orians, 1995; Ryan et al., 2014; M. White et al., 2010). Moreover, the repetitive and abundant experience of water can cause to lose interest and start to be boring, hence, the optimum level should be implemented in practice without exaggerating (Biederman & Vessel, 2006; W. Browning et al., 2014).

2.1.1.4. Fresh Air and Natural Ventilation

Scientific data proved that natural ventilation and fresh air, enhance health and wellbeing, as oxygen is one of the vital elements to survive. For example, by providing indoor air quality with natural ventilation instead of an air conditioner, students' attendance rate can be increased, and sickness rates and Sick Building Syndrome (SBS) symptoms can be diminished (Burge et al., 2004; Drinka et al., 1996; Preziosi et al., 2004; Shendell et al., 2004). Another example study analysed 920 professional middle-aged women in France with monthly surveys. When the participants with natural ventilation in the workplace were compared with the employees in air-conditioned places, 57.1 per cent decrease in illness rate, 16.7 per cent decrease in doctor visits, and 34.7 per cent decrease in hospital stays were observed in participants with opportunity for natural ventilation (Preziosi et al., 2004).

Seppanen et al. (1999)'s review of 43 scientific studies reportedly suggested that natural ventilation is found to be beneficial for reducing headache, mucosal symptoms, influenza, cold, cough, circulatory problems, and sick building syndrome (SBS), and increasing productivity, attention, concentration. The results also suggested that to improve indoor air quality and provide a better state of health, ventilation rates should be higher than 20 cfm and up to 40 cfm per person (Seppanen et al., 1999; 2002).

2.1.1.5. Thermal Comfort and Variability

Thermal discomfort, which is experienced when the temperature goes below 18°C or rises above 24°C, represents not only a lack of satisfaction depending on the environmental temperature but also a potential risk for health. Hence, thermal discomfort can cause respiratory diseases. Specifically, cold temperatures increase the risk of asthma, dry cough and pneumonia, cardiovascular or cerebrovascular events, thickening of the blood, and hypertension, respiratory stress (below 16°C), cardiovascular stress (below 12°C). On the other hand, exposure to high temperatures increases the risk of heat stroke, respiratory and cardiovascular illnesses and deaths (Ormandy & Ezratty, 2015; Sun et al., 2021).

Furthermore, as thermal variability is a part of natural processes, a variety of thermal conditions within a space is found to be comfortable, and beneficial to improving cognitive performance, productivity, concentration, perception, pleasure, and restoring attention (Hartig et al., 2003; J. Heerwagen, 2006; Parkinson & de Dear, 2012; Wigö & Knez, 2005). However, overstimulation can cause boredom, so a moderate level of thermal variability is preferred by occupants (Elzeyadi, 2012; J. Heerwagen, 2006).

2.1.1.6. Natural Materials

Natural materials are stimulating as they reflect the dynamic qualities of organic matter in an adaptive response to challenges of long-term life (S. Kellert & Calabrese, 2015). According to S. Kellert et al. (2011) people usually prefer natural materials rather than artificial even if the artificial ones are visually exact duplicates of the natural material. The reason for this preference might be artificial materials' inability of aging, weathering, and other dynamic features of natural materials.

Based on existing literature, it is found that natural materials' psychological and physiological impact was an under-researched topic. Wood was the only material that has been studied deeply. Current scientific literature suggested that natural materials (mainly wood) improve environmental quality, immune system, recovery from illnesses, and overall health, and encourage creativity and productivity (Q. Li, 2010; McCoy & Evans, 2010; Nyrud et al., 2014; Tsunetsugu et al., 2007). Tsunetsugu et al. (2007) revealed that wooden material application on 45 per cent of the whole surface creates a feeling of comfort and reduces blood pressure and rises pulse rate. On the other hand, 90 per cent of wooden surface coverage decreases brain activity. Research revealed that only a moderate level of wooden material application creates the desired environment (e.g. only floors and furniture), whereas completely wooden covered surfaces or rooms with no wooden material are not usually created desirable environments (Nyrud et al., 2014). (Gillis & Gatersleben, 2015) recommended for future biophilic design research to investigate the impact of different types of natural materials such as clays, stone, earth, straw bale, wool, cotton and so on. Also, indigenous materials' impact on local populations can be investigated.

2.1.1.7. Colour

Colour has been studied by many researchers, however, the impact of natural colours has not been investigated deeply since all colours can be found in nature. Nevertheless, green colour is the most frequently linked colour with nature. Green colour's positive impact on creativity has been proven, moreover, it was claimed that green is more distinguishable than other colours (W. Browning et al., 2014; Lichtenfeld et al., 2012).

Schatz & Bowers (2016) reviewed scientific data on colours' impact in general. Accordingly, colour preference depends on age and place since young people preferred warmer colours and North Americans preferred blue red and green colours respectively while white was also significantly important among Asian people. Colours undoubtedly have an impact on emotions, however, colours' representation can vary by different cultures' socioeconomic and historical traditions. Therefore, scientific data suggested that pink colour reduces aggression, warm-coloured rooms are exciting and have a slightly stimulating impact, while cool colours are calming but can increase a depressing effect. On the other hand, scientific facts had been varying regarding the emotional outcomes for example a research team found that the red colour caused more stress, anxiety, confusion, and tension compared to the blue colour (Kwallek et al., 1997). All studies examined in this review agreed that room colour affects productivity and performance, even though their findings contradicted each other. Besides these contributions, (Schatz & Bowers, 2016) found that colour does not directly affect motivation and satisfaction. Also, scientific studies failed to prove a relationship between perceived temperature and colour, and a relationship between people's appetite and environmental colour.

In conjunction with the ecological valence theory (Palmer & Schloss, 2010): soft and natural blues help to feel relaxed as they remind sky and water; shades of vibrant green give energy and make people calm as they remind of meadow or forest; yellows are warming and welcoming and create a social and energised atmosphere as they remind warm summer and sun; purple and mauves are spiritual and meditative colours, and evokes mystery as they remind dawn and dusk; oranges and reds can be energising, exciting and stimulating as they remind ripe fruits and berries; dark colours associated with sophistication, depth and mystery, and feeling of security and refuge, but if they are not used carefully space can easily be oppressive and overwhelming. With this in mind, using colour in much the same proportions with a sense of harmony, as in nature, is an important point to avoid overwhelming people (Heath et al., 2021).

2.1.1.8. Experiences of Nature

As a dynamic and alive mechanism, nature does not consist of only natural elements but also experiences with its complexity and order, such as prospect, refuge, mystery, risk and peril.

The prospect and refuge concept represents a very basic human instinctive response to the material world "see without being seen" (Lorenz, 1949). Based on this statement, Jay Appleton's *Prospect and Refuge Theory* introduced these two distinctive activities as complementary theories that do not contradict each other. Thus, this theory proposed that human beings were coded to be fully aware of their prey and protect themselves to be a prey, afterwards finding a protected refuge space where they relaxed and have some privacy (Appleton, 1975).

Providing prospects and refuge in space have been found physiologically restorative (Gatersleben & Andrews, 2013). Once looking into these two concepts separately, prospect is found to be reducing stress, fatigue, irritation, and boredom, and improves comfort (Clearwater & Coss, 1991; Grahn & Stigsdotter, 2010; Herzog & Bryce, 2007); while refuge similarly reduces stress, blood pressure, fatigue, perceived vulnerability, and encourages attention, feeling of safety, and concentration (Grahn & Stigsdotter, 2010; Ulrich, 1993; K. Wang & Taylor, 2006). Grahn & Stigsdotter (2010) claimed that health responses for refuge are considerably higher than prospect, nonetheless, health responses are reportedly higher when these two concepts are combined. In Gatersleben & Andrews (2013), the most restorative applications of prospect and refuge combinations were explained. Low-level refuge and high-level prospect combination were found to be restorative whereas a vice versa condition can increase stress, fatigue and negative emotions. Therefore, a moderate prospect distance should be higher than six meters (short depth), although the distance of the preferred prospect was stated as above 30 meters (long depth) (Herzog & Bryce, 2007). Prospect can be applicable in both interior and exterior spaces, an interior prospect is applicable by providing a visual connection between the spaces and it has a greater impact with the opportunity to see multiple spaces together (Hildebrand, 1991).

A true natural setting generates risk which is triggered by nearby danger. The level of the perceived threat and control differentiates risk and fear. While fear in such activities in mountains, forests, or ocean can engender anxiety (Rapee, 1997), controllable risk can lead to positive outcomes such as pleasure or increased dopamine level which supports motivation, problem-solving ability and memory. Nonetheless, an overdose dopamine leads to mood disorders and depression, thus, long-term risk and peril exposure should be avoided (Kandel et al., 2013; Kohno et al., 2015; van den Berg & ter Heijne, 2005). Also, mystery and curiosity stimulate a strong feeling of pleasure (W. Browning et al., 2014).

2.1.2. Current State of Biophilic Design Practice

After the first initiatives that introduced biophilic principles in design, to contribute to both research and practice, several design frameworks were proposed. *Dimensions, Elements and Attributes of Biophilic Design*, *The Practice of Biophilic Design*, and *14 Patterns of Biophilic Design* are the most commonly used and endorsed more detailed perspectives.

The first classification for the biophilic design elements was produced by Kellert in 2008, in the first chapter, *Dimensions, Elements and Attributes of Biophilic Design,* of *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life* (S. Kellert et al., 2011). His classification included six main biophilic design elements that represented 72 biophilic design elements and attributes (Table 2-1):

- Environmental features
- Natural shapes and forms
- Natural patterns and processes
- Light and space
- Place-based relationships
- Evolved human-nature relationships

Table 2-1: Elements and Attributes of Biophilic Design (Kellert, 2008).

Environmental features	Natural shapes and forms	Natural patterns and processes
Colour	Botanical motifs	Sensory variability
Water	Tree and columnar supports	Information richness
Air	Animal motifs	Age, change, the patina of time
Sunlight	Shells and spirals	Growth and efflorescence
Plants	Egg, oval, and tubular forms	Central focal point
Animals	Arches, vaults, domes	Patterned wholes
Natural materials	Shapes resisting straight lines and right angles	Bounded spaces
Views and vistas	Simulation of natural features	Transitional spaces
Façade greening	Biomorphy	Linked series and chains
Geology and landscape	Geomorphology	Integration of parts to wholes
Habitats and ecosystems	Biomimicry	Complementary contrasts
Fire		Dynamic balance and tension
		Fractals
		Hierarchically organized ratios and scales
Light and space	**Place-based relationships**	**Evolved human-nature relationships**
Natural light	Geographic connection to place	Prospect and refuge
Filtered and diffused light	Historic connection to place	Order and complexity
Light and shadow	Ecological connection to place	Curiosity and enticement
Reflected light	Cultural connection to place	Change and metamorphosis
Light pools	Indigenous materials	Security and protection
Warm light	Landscape orientation	Mastery and control
Light as shape and form	Landscape features	Affection and attachment
Spaciousness	Landscape ecology	Attraction and beauty
Spatial variability	Integration of culture and ecology	Exploration and discovery
Space as shape and form	Spirit of place	Information and cognition
Spatial harmony	Avoiding placelessness	Fear and awe
Inside-outside spaces		Reverence and spirituality

This framework superficially examined the biophilic design elements regardless of the applicability to design practice. Also, the framework did not specify any building typology or did not demonstrate any comparison between different parameters. Moreover, the author emphasised that this description was insufficient because this work was still in progress, and the framework will be modified in the future as knowledge in this area increases, leading to some of the categories might overlap. Therefore, Kellert presented a more organised and more focused new framework in 2015, *The Practice of Biophilic Design.*

Table 2-2: Experiences and Attributes of Biophilic Design (Kellert and Calabrese, 2015).

Direct Experience of Nature	**Indirect Experience of Nature**	**Experience of Space and Place**
Light	Images of nature	Prospect and refuge
Air	Natural materials	Organized complexity
Water	Natural colours	Integration of parts to wholes
Plants	Simulating natural light and air	Transitional spaces
Animals	Naturalistic shapes and forms	Mobility and wayfinding
Weather	Evoking nature	Cultural and ecological attachment to place
Natural landscapes and ecosystems	Information richness	
Fire	Age, change, and the patina of time	
	Natural geometries	
	Biomimicry	

The Practice of Biophilic Design proposed a more organised and developed framework that systematised biophilic design parameters in a more comprehensible way to inform the application of design practice. According to *The Practice of Biophilic Design*, written by Kellert and Calabrese, the successful application of biophilic design requires consistently adhering to certain fundamental principles. These principles represent primary conditions for the effective practice of biophilic design (S. Kellert & Calabrese, 2015). The principles were specified as follows (Ibid.):

1. *Biophilic design requires repeated and sustained engagement with nature.*
2. *Biophilic design focuses on human adaptations to the natural world that over evolutionary time have advanced people's health, fitness and wellbeing.*
3. *Biophilic design encourages an emotional attachment to particular settings and places.*

4. Biophilic design promotes positive interactions between people and nature that support an expanded sense of relationship and responsibility for the human and natural communities.

5. Biophilic design encourages mutual reinforcing, interconnected, and integrated architectural solutions.

This renovated framework employed 24 *'attributes'* under three main categories: Direct Experience of Nature, Indirect Experience of Nature, Experience of Space and Place (Table 2-2). However, this framework was also not specific to any building typology but explained the parameters more organised and in more detail. Moreover, the importance level of each parameter was still missing, hence, it did not guide designers in a clear way on how to consider their design is efficiently biophilic.

Apart from Kellert's works on biophilic design, Terrapin Bright Green LLC, a sustainability consulting company that provides support to create a healthier environment, performed extensive research on biophilic design and published a number of reports and books, most notably *Nature Inside: A Biophilic Design Guideline* (2020), Biophilia & Healing Environments (Salingaros, 2015), *14 Patterns of Biophilic Design* (Browning et al., 2014), and contributed some significant publications. The *14 Patterns of Biophilic Design* booklet, published in 2014, introduced a new framework by considering biophilic design parameters in an interdisciplinary context. The primary application principles were explained superficially, and ultimately, it presented the classification that has been the design framework used in many studies in the biophilic design discipline. This book was fundamental in providing a more comprehensive framework to define and assess design based on biophilic principles. The classification was supported by empirical evidence and the work of the authors of the book *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life.* This framework proposed 14 patterns, aimed to be flexible and adaptable for practical use in the application or development of biophilic designs due to their more exact definitions than in previous frameworks (Browning et al., 2014).

The framework developed by Terrapin Bright Green LLC framed biophilic design parameters within 14 titles by naming them "patterns", and classified them within three main categories, as follows (Table 2-3):

- Nature in the Space: the direct, physical and temporary presence of nature in a space or place.
- Natural Analogues: organic, non-living and indirect evocations of nature.

- Nature of the Space: spatial configurations in nature that trigger ancient emotional needs of humankind.

Table 2-3: 14 patterns of biophilic design (Browning et al., 2014).

NATURE IN THE SPACE	NATURAL ANALOGUES	NATURE OF THE SPACE
***Visual Connection with Nature	*Biomorphic Forms & Patterns	***Prospect
**Non-Visual Connection with Nature	Material Connection with Nature	***Refuge
**Non-Rhythmic Sensory Stimuli	**Complexity & Order	**Mystery
**Thermal & Airflow Variability		*Risk/Peril
**Presence of Water		
**Dynamic & Diffuse Light		
Connection with Natural Systems		

As a significant difference from the other two frameworks, *14 Patterns of Biophilic Design* addressed the patterns that were supported by empirical data (indicated with asterisks (*) as shown in Table 2-3). Thus, Visual Connection with Nature, Prospect and Refuge was found to be supported by many scientific facts, whereas scientific data was limited in relation to Material Connection with Nature, and Connection with Natural Systems. The framework is not able to address which parameters are more critical according to building typology or context, although the parameters were scientifically examined. Browning et al. (2014) also listed scientifically supported recommendations to inform general design practice (Table 2-4). Nevertheless, the application of biophilic design specific to building typology is yet to be investigated.

Table 2-4: Design Recommendations from 14 Patterns of Biophilic Design (W. Browning et al., 2014).

PATTERN	DESIGN RECOMMENDATIONS
VISUAL CONNECTION WITH NATURE	• Prioritise real nature over simulated nature; and simulated nature over no nature • Prioritise biodiversity over acreage, area or quantity • Prioritise or enable exercise opportunities that are in proximity to green space • Design to support a visual connection that can be experienced for at least 5-20 minutes per day • Design spatial layouts and furnishings to uphold desired view lines and avoid impeding the visual access when in a seated position • Visual connections to even small instances of nature can be restorative, and particularly relevant for temporary interventions, or spaces where real estate (floor/ground area, wall space) is limited. • The benefits of viewing real nature may be attenuated by a digital medium, which may be of greatest value to spaces, due to the nature of its function (e.g., hospitals radiation unit) cannot easily incorporate real nature or views to the outdoors.
NON-VISUAL CONNECTION WITH NATURE	• Prioritise nature sounds over urban sounds • Design for non-visual connections that can be easily accessed from one or multiple locations, and in such a way that allows daily engagement for 5 to 20 minutes at a time • Integrate non-visual connections with other aspects of the design program • A single intervention that can be experienced in multiple ways can enhance the impacts

	• Design for visual and non-visual connections to be experienced simultaneously to maximize potential positive health responses
NON-RHYTHMIC STIMULI	• As a general guideline, non-rhythmic sensory experiences should occur approximately every 20 minutes for about 20 seconds and, for visual stimuli, from a distance of more than 20 feet away. 28 14 Patterns of Biophilic Design • Many stimuli in nature are seasonal, so a strategy that is effective year-round, such as with multiple interventions that overlap with seasons, will help ensure that non-rhythmic sensory experiences can occur at any given time of the year. • In some cases, the intervention may be similar to that of [P1] Visual or [P2] Non-Visual Connection with Nature; what's important here is the ephemeral and stochastic quality of the intervention. • An intervention that leverages simulation (rather than naturally occurring) natural stimuli will likely necessitate early collaboration with the mechanical engineer or facilities team. • A non-rhythmic stimuli strategy can be interwoven with almost any landscape or horticulture plan. For instance, selecting plant species for window boxes that will attract bees, butterflies and other pollinators may be a more practical application for some projects than maintaining a honeybee apiary or butterfly sanctuary. • Humans perceive movement in the peripheral view much quicker than straight ahead. The brain also processes the movement of living things in a different place than it does of mechanical objects (Beauchamp et al., 2003), whereby natural movement is generally perceived as positive, and mechanical movement as neutral or even negative. As a result, the repeating rhythmic motion of a pendulum will only hold one's attention briefly, the constant repetitive ticking of a clock may come to be ignored over time, and an ever-present scent may lose its mystique with long-term exposure; whereas, the stochastic movement of a butterfly will capture one's attention each time, for recurring physiological benefits.
THERMAL & AIRFLOW VARIABILITY	• Incorporation of airflow and thermal conditions into materials, daylighting, mechanical ventilation and/or fenestration will help distribute variability over space and time. • Thermal comfort is a vital bridging component between biophilic design and sustainable design, especially in the face of climate change and rising energy costs. When thermal and airflow variability is implemented in a way that broadens people's perception of thermal comfort, it may also help reduce energy demands for air conditioning and heating. • Designing in features that allow users to easily adapt and modify their perceived thermal conditions of their environment will increase the range of acceptable temperatures by two degrees Celsius above and below the conventional parameters for thermal comfort (Nicol & Humphreys, 2002). • Coordination of design strategies among a project team (e.g., architect, lighting designer and MEP engineers) as early as the schematic design process will be particularly important for achieving design intent.
PRESENCE OF WATER	• Prioritise a multi-sensory water experience to achieve the most beneficial outcome. • Prioritise naturally fluctuating water movement over predictable movement or stagnancy. • High volume, high turbulence water features could create discomfort, impact humidity levels or decrease acoustic quality, so proximity may influence appropriateness. • Water features can be water and energy intensive and as such should be used sparingly, particularly in climates with little access to water. Shading the water, using high albedo surfaces, and minimizing the exposed water surface area will minimize water loss through evaporation, and possibly contribute to the biophilic experience.
DYNAMIC & DIFFUSE LIGHT	• Dynamic lighting conditions can help transition between indoor and outdoor spaces. • Drastically dynamic lighting conditions, such as with sustained movement, changing colors, direct sunlight penetration and high contrasts, may not be appropriate for spaces where directed attention activities are performed. • Circadian lighting will be especially important in spaces the people occupy for extended periods of time.
CONNECTION WITH NATURAL SYSTEMS	• Integration of rainwater capture and treatment into the landscape design that respond to rain events • In some cases, providing visual access to existing natural systems will be the easiest and most cost-effective approach. In other cases, the incorporation of responsive design tactics (e.g., use of materials that change form or expand function with exposure to solar heat gain, wind, rain/moisture, or shading), structures (e.g., steps wells), and land formations (e.g., bioswales, arroyos, dunes) will be necessary to achieve the desired level of awareness • Design for interactive opportunities, especially for children, patients, and the elderly (e.g., integrative educational curriculum; horticulture programs, community gardens; seasonal cooking/diet)

BIOMORPHIC FORMS & PATTERNS	• Apply on 2 or 3 planes or dimensions (e.g., floor plane and wall; furniture windows and soffits) for greater diversity and frequency of exposure. • Avoid the overuse of forms and patterns that may lead to visual toxicity • More comprehensive interventions will be more cost effective when they are introduced early in the design process.
MATERIAL CONNECTION WITH NATURE	• Quantities of a (natural) material and colour should be specified based on intended function of the space (e.g., to restore versus stimulate). In the same vein, a degree of variability of materials and applications is recommended over high ratios of any one material or colour. • Real materials are preferred over synthetic variations because human receptors can tell the difference between real and synthetic, so minimally processed materials from real nature are preferred whenever possible. • Incorporating instances of the colour green may help enhance creative environments; however, scientific studies on the impact of the colour green have mostly been conducted in controlled lab environments, so dependence on colour to engender creativity should be considered experimental.
COMPLEXITY & ORDER	• Prioritise artwork and material selection, architectural expressions, and landscape and master planning schemes that reveal fractal geometries and hierarchies. • Fractal structures with iterations of three will be more impactful than a design limited to two iterations. • Computer technology using the algorithms of mathematical and geometric functions can produce fractal designs for architectural, design and planning applications with ease. If a fractal design is being created, consider using geometries with a mid-range dimensional ratio (broadly speaking, D=1.3-1.75). • Over-use of and/or extended exposure to high-fractal dimensions could instil discomfort or even fear, countering the intended response: to nourish and reduce stress. Avoidance or under-utilization of fractals in design could result in complete predictability and disinterest. • A new building or landscape design should take into account its impact on the fractal quality of the existing urban skyline.
PROSPECT	• Orienting building, fenestration, corridors and workstations will help optimize visual access to indoor or outdoor vistas, activity hubs or destinations. • Designing with or around an existing or planned savanna-like ecosystem, body of water, and evidence of human activity or habitation will help the information-richness of the prospect view. • Providing focal lengths of ≥20 feet (6 meters), preferably 100 feet (30 meters); when a space has sufficient depth, spatial properties can be leveraged to enhance the experience by removing visual barriers. Limiting partition heights to 42” will provide spatial barriers while allowing seated occupants to view across a space. Understory vegetation or hedges should use a similar guide; preferred height limitations will depend on terrain and how the space is most experienced (e.g., while sitting, standing, on a bicycle) • Locating stairwells at building perimeter with glass façade and interior glass stairwell walls can form a dual prospect condition. • When high ceilings are present, perimeter or interior spaces elevated 12-18” will enhance the Prospect condition. • Often the view quality and the balance between Prospect and Refuge will be more important than the size or frequency of the experience. • Refer to [P1] Visual Connection with Nature to optimize the Prospect experience with a quality view.
REFUGE	• Indoor refuge spaces are usually characterized by lowered ceiling conditions. For spaces with standard ceiling heights, this may equate to approximately 18-24 inches below the main ceiling, and is often achieved through treatments like a soffit, a drop-ceiling or acoustical panelling, or suspended fabric. • Outdoor or indoor spaces with particularly high ceilings (>14 feet), a more drastic differential may be necessary to achieve the desired outcome; freestanding or vegetative alcoves and mezzanine-like structures are often effective. • When designing for larger populations or multiple activity types, providing more than one kind of refuge space can address varying needs, which can often be met through differing spatial dimensions, lighting conditions, and degree of concealment. • Light levels in refuge spaces should differ from adjacent spaces and user lighting controls will broaden functionality as a refuge space.
MYSTERY	• Curving edges that slowly reveal are more effective than sharp corners in drawing people through a space. • Dramatic shade and shadows can enhance the mystery experience. • Strategies that provide dark shadows or shallow depth of field could instil unappreciated surprise or fear.

	• The speed at which users are transiting through a space will influence both the size of the aperture and the size of the subject; faster typically means bigger. • Organically evolved mystery conditions (e.g., low maintenance gardens with winding paths) are expectedly going to change characteristics over time. These changes should be monitored as they may enhance the mystery condition, or otherwise degrade it as it evolved into a surprise condition (e.g., overgrowth of plantings leads to obscuring of depth of field).
RISK/PERIL	• Risk/Peril design interventions are usually quite deliberate and as such will not be appropriate for all user groups or places. • Design strategies that rely on spatial conditions will be easier to implement when incorporated as early as concept design and schematic phases of the design process. • The element of safety must protect the user from harm while still permitting the experience of risk.

A recent publication, *Nature Inside: A Biophilic Design Guideline* (W. D. Browning & Ryan, 2020), by the same authors introduced a guideline based on the same biophilic design framework with *14 Patterns of Biophilic Design*, but increasing the number of Patterns to 15 by adding 'Awe'. This guideline explained the economics and design steps for the biophilic design process (Figure 2-1). This design guideline examined case studies of applied biophilic design regarding different building typologies: housing, schools, retail, offices, hotels, hospitals, factories, and communal spaces. However, the guideline did not direct designers on a clear path, although it presented successful examples.

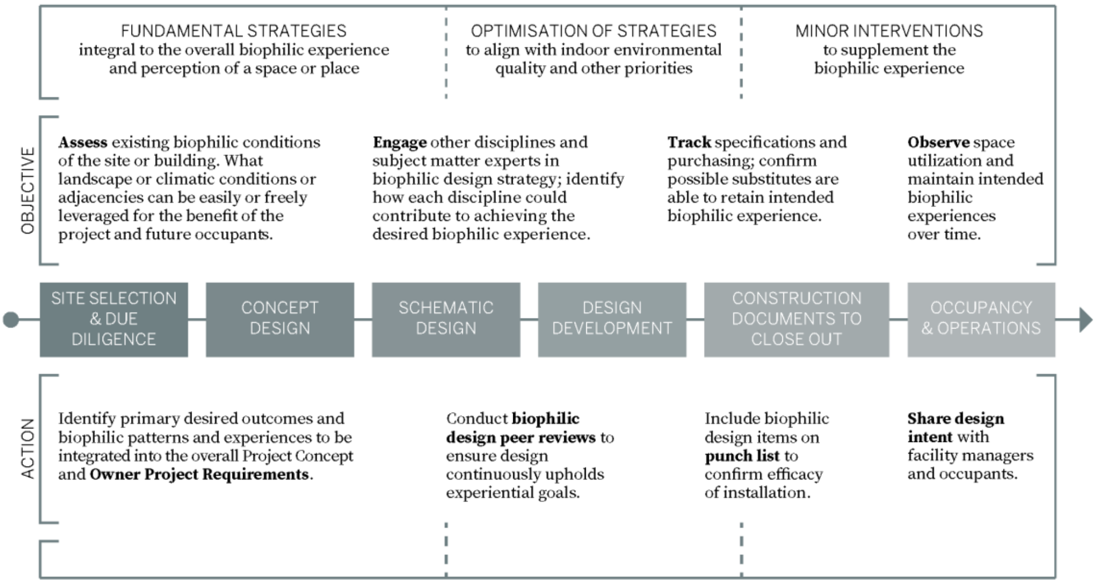


Figure 2-1: Decision Timeline for Biophilic Design Implementation *(W. D. Browning & Ryan, 2020)*.

In order to consider biophilic design elements and attributes effectively during the data collection stage, their inclusion in this research, reported in the following chapters, did not completely follow any of these frameworks, because of their unclear transitions and contradicting parts to each other. The parameters investigated in this thesis took form throughout the analysis of collected data. Therefore, the employed parameters were evaluated in two main groups: Parameters of the physical environment: Fresh Air, Daylight, Thermal Comfort, Multisensory Environment, Spaciousness, View, Natural Colour, Greenery-Plants, Natural Material, Seasonal Changes, Water, Fire, Spaciousness; and parameters of emotional and psychological wellbeing: Refuge-Privacy, Prospect, Sense of Belonging, Curiosity, Welcoming and Relaxing Feelings, Mastery and Control.

The term 'parameter' was selected as a collective definition of elements, attributes, or patterns. While the term 'element' was used for physical or assessable components of biophilic design (e.g. natural material, light, greenery, water, etc), the term attributes commonly referred to emotional and sensational features of the biophilic design (e.g. prospect, refuge, enticement, sense of belonging). The use of the term 'pattern' is peculiar to the concepts defined in *14 Patterns of Biophilic Design,* thus*, the 'pattern'* term will always refer to this specific framework.

2.1.3. Standards

As a design philosophy, biophilia does not well fit quantitative measurement tools. However, health-oriented metric certification systems somewhat include biophilic design in their programme. Particularly, some green building standards incorporate biophilic design. For example, BREEAM (Building Research Establishment Environmental Assessment Method), founded by the Building Research Establishment (BRE) in 1990 in the UK, includes criteria in relation to health and wellbeing in which Hea 01 Visual comfort, Hea 02 Indoor air quality, Hea 04 Thermal comfort, Hea 07 Hazards (Safe and Healthy Surroundings), and Hea 08 Private space topics can be considered assessment of some biophilic values (*BREEAM International New Construction Version 6*, 2021). On the other hand, LEED (Leadership in Energy and Environmental Design), developed by the U.S. Green Building Council (USGBC) in 1993 in the USA, more directly employs biophilic design in some topics: EQpcl23 Designing with Nature, Biophilic Design for the Indoor Environment; SS Open Space; SS Protect or Restore Habitat; MR Building Product Disclosure and Optimisation; MRpcl02 Legal Wood; EQ Enhanced Indoor Air Quality Strategies; EQ Interior Lighting; EQ Daylight; EQ Quality Views; EQ Acoustic Performance.

However, at present two certification systems take biophilic design as a focus in the assessment process: the WELL Building Standard and the Living Building Challenge (LBC). The Living Building Challenge (LBC) is an international sustainable building certification programme created in 2006 by the Seattle (U.S.A)-based non-profit International Living Building Institute. LBC applies a holistic set of building performance standards that certify new construction, renovations, and exterior spaces such as landscaping and infrastructure projects (International Living Future Institute, 2019). The Living Building Challenge certification programme consists of seven “Petals”, which act as performance categories: Place, Water, Energy, Health & Happiness, Materials, Equity and Beauty. There are 20 “Imperatives” in total, which are organised into seven Petals. Imperatives are specific strategies or goals that help to provide understanding for a topic or guideline. Certification can be awarded based on the employed Petals, each of which should be fulfilled based on the imperative requirements (Figure 2-2). Some of the Imperatives are directly or indirectly relevant to biophilic design: 04 Human Scaled Living, 09 Healthy Interior Environment, 10 Healthy Interior Performance, 11 Access to Nature, and 19 Beauty + Biophilia (International Living Future Institute, 2019).

The Living Building Challenge also includes a biophilia design initiative that is used as a resource for designers and architects. The initiative provides a resource for ideas, events, and networking opportunities, as well as access to network archives and file resources related to biophilic design. Designers may also have an opportunity to develop their own draft of biophilic implementation strategies and documents for the Living Building Challenge (International Living Future Institute, 2019).

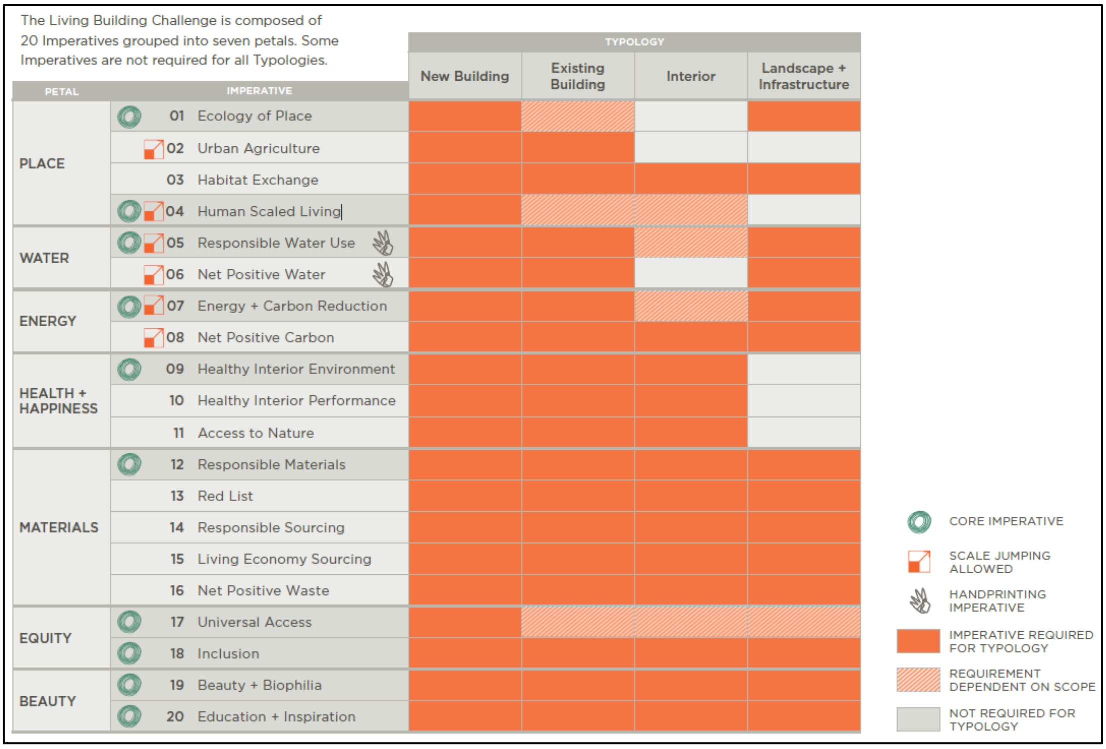


Figure 2-2: Summary of LBC criteria (International Living Future Institute, 2019).

The WELL Building Standard, founded in the USA in 2013 and administered by the International WELL Building Institute (IWBI), exclusively focuses on human health and wellbeing in the built environment (IWBI, 2021). The WELL Building Standard certifies new constructions or renovation projects. The current version of the standard, WELL V2, contains 11 concepts, including Air, Water, Nourishment, Light, Movement, Thermal comfort, Sound, Materials, Mind, Community, and Innovations. Within WELL V2, some biophilic design principles were integrated into eight features under five concepts: Air 07: Operable Windows, Light 03: Circadian Light Design, Light 05: Enhanced Daylight Access, Mind 02: Access to Nature, Mind 07: Restorative Spaces, Mind 09: Enhanced Access to Nature, Sound 05: Sound Masking, Thermal Comfort 03: Thermal Zoning (IWBI, 2021).

Regarding the Access to Nature feature, the standard's provision for direct connection to nature is at least two of the following biophilic design features to be achieved through design: plants, water, light, or nature scenes. On the other hand, an indirect connection to nature is proposed to be achieved by using colour, patterns, natural materials, or images. The Enhanced Access to Nature feature must employ at least two of the following conditions (IWBI, 2021):

- Outdoor access to nature: at least 25% landscaping or gardens which consist of real plants or natural elements (at least 70%).
- Indoor access to nature: at least 75% of spaces should be occupied with indoor plants, and advised to be supported by safe water features.
- Nature views: at least 75% of occupied spaces should have visual contact with exterior nature views in direct line of sight.
- Nearby access to nature: at least one green space (minimum 0.5 Hectares) within 300 meters of walking distance from the built environment.

To sum up, in both certification systems (LBC and WELL), there is not enough definite requirement for biophilic design elements holistically. Although they deal with several biophilic parameters in the rating process. Thus, biophilic design is accepted as only one of the supportive tools to be able to accomplish standards' requirements.

2.2. Concluding Remarks

The literature review conveyed in this chapter is critically important to understand the biophilia and biophilic design, the importance and benefits of connecting with nature and natural elements which also informs and helps to define ways to answer the research question by contributing design recommendations for biophilic therapeutic environments. Furthermore, having insight into the current state of biophilic design from different perspectives (research, practice and regulations) strengthen the main goal by underpinning the importance of how this research will contribute scientific and practical knowledge.

The second part of the literature review, in Chapter 2, revealed why improving environmental quality with biophilic design is necessary for healthcare environments with the historical and theoretical background of the healing environment concept.

CHAPTER 3

3. HEALING ENVIRONMENT

The World Health Organization (WHO) defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" ("Constitution of the World Health Organization," 1946). In line with this statement, the theory underpinning the concept of a therapeutic environment, claims that the characteristics of the physical environment in which a patient receives healthcare affect the patient's recovery period or adaptation to particular acute and chronic conditions (Stichler, 2001). Healing environments should not only be places where patients are treated with the most advanced medicine and technology but also places that support their users (staff, patients and their families), in psychological, emotional and social terms (Smith & Watkins, 2016).

Smith & Watkins (2016) claim that all environments have a positive or negative impact, thus, there is no neutral environment. So, they explain the criteria that make the healthcare environments therapeutic in a positive way:

- *Supports clinical excellence in the treatment of the physical body*
- *Supports the psycho-social and spiritual needs of the patient, family, and staff*
- *Produces measurable positive effects on patients' clinical outcomes and staff effectiveness* (Smith & Watkins, 2016).

A sustainable therapeutic environment is guided by thinking about health and well-being in its broadest context (Boscherini, 2017) by an understanding that includes the health and well-being of building occupants, the health of the local community and the natural resources and health of the global community (Peters, 2017).

The existing literature frequently uses the terms "healing environment" and "therapeutic environment" interchangeably. Nevertheless, this thesis will use the term "therapeutic environment" to refer to all healing environments regardless of their size, and clinical or non-clinical function.

3.1. Environment and Healthcare: Examples of Connection with Nature from History

Healthcare architecture is not a new practice. Although the architecture of health has been poorly documented and historic physical remains have not survived well, its root goes back to ancient times and can be tracked as early as Ancient Egypt and Ancient Greece.

There is extensive research on the evolution of hospital design and healing environments and their historical background from which we learn there are numerous examples of the inclusion of natural elements in the healing process. Earliest examples may be Asclepeion temples in ancient Greece, a collection of buildings against a stunning landscape that served as a kind of healthcare setting that was visited by terminally and chronically ill people (Heathcote, 2021; Sternberg, 2009; Thompson & Goldin, 1975). They were built far from the high temperature, noise, dirt, and dust of the settlements, typically with a good view of the sea and nearby freshwater sources (Sternberg, 2009). Despite they were not hospitals, the idea of holistic treatment was prevailing in these therapeutic temples where patients followed special diets, and prayers along with fresh air, view of nature, fresh water, music, and socialising. The cure in Asclepeion was cultural, spiritual, and medicinal (Heathcote, 2021; Sternberg, 2009).

Roman Valetudinariums, Islamic Bimaristans, Medieval Hospices, Renaissance Hospitals and many other historical examples used courtyards and gardens as main providers of nature connection. Courtyards offered sheltering spaces where the patient could still go out and experience fresh air and sunlight while being sheltered. Some examples also included water elements such as fountains or pools to create sensory variability (Cilliers & Retief, 2002; Heathcote, 2021; Saliu et al., 2016; Thompson & Goldin, 1975; Verderber & Fine, 2000). Courtyard development and the use of natural elements was commonly observed in Bimaristans. These centres aimed to heal not only the physical body but also the soul and mental health of patients through both programme and architecture. Each department had fountains to supply fresh water and an auditory experience. Outpatient departments and inpatient wards were naturally ventilated. Music was played in the courtyards for those who had difficulty sleeping. Musicians and storytellers entertained the users, and each patient received a sum of money at discharge to afford expenses until resuming work (Cilliers & Retief, 2002; Heathcote, 2021; Porter, 1997). Along with the courtyards and gardens, Renaissance period hospitals integrated new construction techniques and innovations, which helped to increase natural elements such as daylight, fresh air, fireplaces and so on (Verderber & Fine, 2000). For example, Filarete's Ospedale Ca'Granda in Milan, the first building to use cross-plan had two cross-shaped wards, each designed for 60 beds, surrounded by courtyards (Saliu et al., 2016; Thompson & Goldin, 1975), while the design of courtyards as secondary public space in Hospital Real at Santiago de Compostela in Spain encouraged privacy and silence (Heathcote, 2021).

Overall, while traditionally approached, healthcare settings were early examples of biophilic thinking since they were usually built far from the high temperature, noise, dirt, and dust found in towns, and they typically offered a good view of nature and nearby freshwater sources.

With the Enlightenment and modernity, healthcare design emerged as an architecture that was supported by science and objectivity. Radical changes in the hospital design were started by the fire at Hotel Dieu in Paris in 1772. The biggest and one of the earliest hospitals in Europe, in which 1,280 patients were accommodated every year, it had a series of courtyards located on the bank of the Seine River that supported the building by providing water, ventilation and fresh air (Heathcote, 2021). However, records from before its destruction by a fire concluded that one out of four and a half patients were dying in that hospital. Therefore, the debates on reconstruction led the design committees to critically think about an effective hospital design (Wagenaar, 2006), although these deliberations were focused on the building's layout (Heathcote, 2021), as the reformers assumed that it was not the medicine that provided the healing conditions, but the clean air provided by the surrounding natural environment (Wagenaar, 2006). These debates led the designers to design smaller day-lit and naturally ventilated pavilion buildings that were connected with arcades as happened in the Royal Naval Hospital in Stonehouse in Plymouth, which achieved great success in healthcare as an example of pavilion layout hospitals (Heathcote, 2021).

Another noteworthy example to understand the importance of environmental conditions for healing in the course of historical evolution is the works of Florence Nightingale. The importance of designing a healing environment was widely accepted after Florence Nightingale asserted her observations during the Crimean war in 1854. Nightingale was a trained nurse and statistician who joined the frontline to treat wounded British soldiers in Üsküdar, Istanbul, where the old military barracks were allocated to the British forces as a temporary hospital. She realised that the majority of casualties were caused not by the war wounds but by the rapidly transmitted diseases due to the lack of ventilation and light, and poor conditions of the aid tents and the old barracks. After she reported these conditions to London, prefabricated wards designed by Isambard Kingdom Brunel were produced in the UK and assembled in Renkioi (Erenköy, Turkey) in 1855. All wards were self-sufficient with nurses' rooms, lavatories, and an operating theatre. The Renkioi hospital, which was made of wood and fully insulated, offered a healing environment with ventilating windows that provided sufficient daylight. The astonishing results showed the mortality rate fell from 42 per cent to two per cent (Heathcote, 2021; Murphy & Mansfield, 2017). Nightingale’s principles, published in her book *Notes on Hospitals* in 1863, outlined the design of wards, quantity of windows, daylight quality, bed placement, spaciousness, the atmosphere of space, heating and ventilation systems, material and colour (Murphy & Mansfield, 2017; Nightingale, 1859; Verderber & Fine, 2000). After her return from the frontline, she worked for hospital reform and influenced many pavilion hospitals in London and Paris (Heathcote, 2021).

Nightingale’s principles were followed in the late 19th and early 20th centuries, however, these principles have been progressively disregarded when the dramatic growth of urbanisation together with the advent of the Miasma and Germ theories, led to an environmental approach to healthcare exclusively focused on healing with medical interventions (Murphy & Mansfield, 2017; Wagenaar, 2006), so the idea of pavilion hospitals was abandoned in favour of basic hygiene (Heathcote, 2021). Secondly, the invention of the X-ray and the Röntgen machines started a new era in hospital design. These expensive machines were kept in the hospitals, therefore rather than receiving treatment at home, the upper-class population started to use the hospital, which until then had been only used by the poorest people (Wagenaar, 2006). Thereafter, ongoing criticism about the need for patient privacy, not being adaptable to a ward system, and rapidly increasing population and developing technology brought massive and complex block hospitals: the concept of *'Mega-hospitals’* (Verdeber and Fine, 2000).

Regarding the ‘Mega-hospital’ concept, Wagenaar (2006) explained: "Great and monumental though these hospitals could be, they lost an essential architectural feature of older pavilion system: the ambition to create healing environments that emulated nature". The natural environment was abandoned in healthcare setting design as the only focus was accommodating science and technology efficiently and cost-effectively. Everything in these massive and urban buildings was subject to the requirements of science and technology disregarding human needs and well-being (Wagenaar, 2006). However, this was not the case for all healthcare buildings in the first half of the 20th century. For example, in Alvar Aalto’s Sanatorium in Paimio (1929-1933), where the architect designed the centre in every detail with a combination of industrial, organic, and aesthetics as an exemplar of the architecture of convalescence, calm and clarity by including plenty of daylight, visual connection with nature and greenery, and balconies where patients have easy access to the outdoor (Heathcote, 2021).

When looking at the post-war healthcare examples, their planning mainly privileged the building's circulatory systems and mechanisation to increase efficiency in the use of human and technical resources, rationalising and accelerating the delivery of clinical care (reducing in-patient lengths of stay to the minimum clinically necessary and through increases in day surgery and out-patient treatment) (Hughes, 1997). Nightingale's principles were progressively disregarded in this process, which together with the dramatic growth of urbanisation, the advent of the germ theory and rapid changes in medical technology, led to an environmental approach to healthcare exclusively focused on healing through medical interventions (Murphy & Mansfield, 2017). Verderber and Fine (2000) defined these new facilities as Minimalist Megahospitals where newly formed departments and more specialised healthcare zones were included. This approach also did not prioritise connection with natural elements to encourage the healthcare facilities toward efficiency, sanitary and controlling infection (Heathcote, 2021; Wagenaar, 2006).

However, the healthcare environment became more patient-centred with the help of the health insurance system and capitalist ideology, although today's healthcare environment is still criticised. Healthcare environments have focused on the goals and objectives of the organisation (fast physical recovery, mass health) while widely neglecting the users (staff, patients) concerns and aspirations, and with this, their emotional, mental and spiritual health (Abdelaal & Soebarto, 2019; Murphy & Mansfield, 2017; Silverstein, 2009). In this context, Verdeber and Fine (2000) stated that hospitals are considered as "healing machines", and Charles Jencks, co-founder of Maggie's Centres, described today's healthcare settings as 'factory-hospitals' where all technology and medicine are dedicated to mass health. With the creation of Maggie's Centres, Jencks evidenced the need for and pursued the provision of non-clinical therapeutic support centres (Jencks, 2017).

Supporting emotional, mental, and spiritual health is essential, particularly for patients who have been given a diagnosis with cancer, as numerous studies have shown that these patients may experience significant levels of psychological discomfort, with many of them reporting fatigue, anxiety, or depression. (Blazer et al., 1994; Guthrie, 1996; Mayou et al., 1991; McDaniel et al., 1995; Turner & Kelly, 2000; Zabora et al., 1997). Supporting evidence suggests that the physical qualities of the healthcare setting influence health and well-being outcomes (Evans, 2003; Galea et al., 2005; Laursen et al., 2014; T. H. M. Moore et al., 2018; Rao et al., 2007; Ulrich et al., 1991; Yadav et al., 2018). In this context, it has become increasingly essential to reconsider hospital design and the therapeutic environment concept, as it should be a place that supports its users (staff, patients, and their families), in psychological, emotional, and social terms, in addition to being a place where patients are treated with the most cutting-edge medicine and technology (Smith & Watkins, 2016; Ulrich et al., 2008).

Evidence of health benefits associated with exposure to nature includes pain reduction, less medication, lower blood pressure, faster recoveries and decreased all-cause mortality in general (S. H. Park & Mattson, 2009; Ulrich, 1984). Biophilic design also has a crucial effect on supportive care, particularly important for cancer patients, who often have to deal with psychological distress, fatigue, anxiety or depression (Clarke & Currie, 2009; DeJean et al., 2013; Evans, 2003; Laursen et al., 2014; T. H. M. Moore et al., 2018; Turner & Kelly, 2000; Ulrich et al., 1991). Contact with nature has shown to promote emotional, mental and spiritual health, reducing stress and triggering positive shifts in mood (Abdelaal & Soebarto, 2019; Berman et al., 2008; Murphy & Mansfield, 2017; Silverstein, 2009).

The focus of this research is not analysing clinical environments but rather focusing on the crucial role of the environment to give psychological support. To this end, not only biophilic design as a framework has focused on this support, as a range of design theories have emerged in this direction. The next section will briefly introduce some of the therapeutic design theories that follow this approach.

3.2. Other Relevant Theories and Approaches of Therapeutic Environment

3.2.1. Stress Recovery Theory (SRT)

Initially, Stress Recovery Theory (SRT) was introduced by Roger S. Ulrich in 1983. SRT is a critical framework to explain nature's restorative effects (Ulrich, 1983; Ulrich et al., 1991). This theory specifically tries to clarify how exposure to nature can help people experience less psychophysiological stress. According to SRT, natural environments and elements still evoke pleasant effects in people of modern ages as the modern human brain is configured for prehistoric behaviours according to Evolutionary Psychology (Cosmides & Tooby, 1997), which may subsequently decrease psychophysiological stress (Ulrich, 1993). Basically, SRT claims that human beings are biologically equipped to show positive impacts from nature and natural processes. Therefore, contact with nature can generate a quick impact that reduces negative emotions and helps to recover from stress and health problems (Parsons et al., 1998; Ulrich, 1983, 1993; Ulrich et al., 1991).

3.2.2. Attention Restoration Theory

Another important framework that explains nature's restorative effects is Attention Restoration Theory (ART), which was introduced by Rachel and Stephen Kaplan in 1989. ART's fundamental belief is that there are two types of attention that people can depict: "Directed attention" which requires an effort that can cause mental fatigue, and "soft fascination" which might help restoration from directed attention fatigue. ART discusses the restorative benefits of natural settings in terms of recovering from directed attention fatigue. The theory proposes that interaction with nature helps to relieve stress and mental fatigue without much cognitive work (R. Kaplan & Kaplan, 1989; S. Kaplan, 1995; S. Kaplan & Berman, 2010). In ART's proposal, individuals can benefit from being away from everyday stress, engaging in endeavours that are "compatible" with human innate tendencies, and experiencing stimuli (S. Kaplan, 1995). According to ART, nature can particularly play a role to provide restorative opportunities because of its "aesthetic advantage"(R. Kaplan & Kaplan, 1989; S. Kaplan & Berman, 2010). In contrast to SRT, which focuses on people's immediate emotional reactions to nature as a source of restoration, ART concentrates on the potential cognitive advantages that may result from contact with natural environments.

3.2.3. Supportive Design Theory

Supportive Design Theory, as a continuation of SRT, emerged as a result of Roger Ulrich's interpretation of his studies that proved the impact of the physical environment on humans in healthcare settings (Hamilton & Watkins, 2008; Ulrich et al., 1991). The theory defends that designing healthcare settings should aim more than functionally efficient budget 'healing factories', and designers can achieve this goal by encouraging well-being by creating a psychologically and socially supportive physical environment (Ulrich, 2000).

Supportive healthcare design should be patient-centred and help patients cope with stress and anxiety, rather than merely complementing medical treatment. Ulrich (2000)'s guideline leads designers to enhance patient control and privacy, improve social support, and increase access to nature for creating patient-centred healthcare settings. Hereby, he claimed that a `supportive design' will reduce stress and anxiety, improve sleeping, reduce pain, lower infection occurrence, and improve satisfaction. Along with the patient's outcome, it will be beneficial for staff in terms of reduced stress, improved job satisfaction, the possibility of reduced turnover, and greater attraction of qualified employees. Moreover, the application of supportive design saves costs by improving medical outcomes and staff's quality of life (Ulrich, 2000).

3.2.4. Therapeutic Environment Theory

Therapeutic environment theory claims that typical hospitals increase patients' stress levels, which can facilitate immune system disorder, emotional destruction and hamper recovery. The theory of the therapeutic environment derives from the fields of environmental psychology, neuroscience and psychoneuroimmunology (Smith & Watkins, 2016). The theory proposes four factors for designing a healthcare environment to reduce the stress of patients and their families (Ibid.):

- Reduce or eliminate environmental stressors
- Provide positive distractions
- Enable social support
- Give a sense of control

Application of these four factors provides new environmental conditions such as; access to daylight and appropriate lighting, noise reduction, appropriate use of technology, and same-handed patient rooms (standardises all rooms within a unit) (Watkins et al., 2011), providing 'off-stage' areas for respite. Furthermore, this theory suggests that new environmental conditions can also improve staff in terms of satisfaction, and effectiveness; thus, staff's improvement will help patients' outcomes (Smith & Watkins, 2016).

3.2.5. Evidence-Based Design (EBD) Approach

Evidence-based design (EBD) is a novel concept in architectural healthcare design in the 21st century. The Centre for Health Design (About EBD | The Center for Health Design, 2022.) defines EBD as "the process of basing decisions about the built environment on credible research to achieve the best possible outcomes".

As design decisions are based on reliable scientific evidence, this strategy aims to provide a closer match between design intentions, and medical and organizational outcomes. Thus, the conceptual sub-categories of EBD were defined as; access to nature, options and choices, positive distractions, social support, environmental stressors, and clear design steps to reduce stress and enhance the recovery of patients (Freimane, 2013).

Ulrich et al. (2008) claimed that EBD can help designers to create a healthcare environment that is comfortable and less stressful for all users and can provide a faster recovery to patients.

3.2.6. Salutogenic Approach

The theory of Salutogenesis was introduced by Aaron Antonovsky in 1979 in his book *Health, Stress and Coping* (Mazuch, 2017). The term Salutogenesis stands for 'health origins', coined from the Latin *salus* meaning health, and the Greek *genesis* for origin (Antonovsky, 1979). The Salutogenesis concept focuses on active health and wellbeing rather than a pathogenic approach that focuses exclusively on resultant disease and injury (Mazuch, 2017).

The framework for salutogenic design incorporates three key factors (Boscherini, 2017): welcoming spaces for meeting and social exchange; familiar spaces for orientation and reassurance; and quiet spaces for meditation and restoration.

Salutogenesis claims that coping with stress mainly is an outcome of the quality of the environment which is in relation to the individual's sense of coherence (Lyon, 2017). Boscherini (2017) explained the relationship between the physical environment and an individual's sense of coherence as:

> *We understand this commonly as 'keeping it together' in the face of adversity, and it manifests itself, when facing serious health challenges, through manageability: the availability of resources and a supportive social network; comprehensibility, intended as a comforting backdrop that offers order and familiarity; and meaningfulness, understood as the inspiring realisation that there are important 'phenomena' in life and nature.*

Dilani (2014) explained salutogenic design as: "An approach used to promote health and well-being by creating a built environment that includes wellness factors, contributing to the sense of well-being for staff and strengthening the healing process. It provides a basic theoretical framework for psychosocially supportive design." He also emphasised that implementing salutogenic designs into healthcare facilities can accelerate the recovery of health.

Although salutogenic design is very commonly mentioned along with biophilic design. It is mainly about promoting active health and wellbeing rather than only coping with illnesses pathogenically, while biophilic design is mainly about helping the healing process and wellbeing by cooperating with nature (Boscherini, 2017).

3.2.7. Psychosocially-Supportive Design (PSD)

The Psychosocially Supportive Design (PSD) framework, introduced by Alan Dilani, focuses on promoting environmental qualities in clinical environments to support psychosocial behaviours which are neglected due to merely concentrating on treating patients. PSD encourages patients socially and mentally and also promotes their sense of coherence. This approach primarily strives for attracting attention to start a mental progression that will promote positive psychological emotions and may cope with anxiety (Dilani, 2008). Dilani (2008) explained how to employ the PSD approach as:

> *Psychosocially supportive design should incorporate and consider factors such as access to symbolic and spiritual elements; access to art; good lighting; attractive space for social interactions; private spaces; and an interior environment that provides positive experiences. Other factors include visual and physical access to nature, and personal control over, for example, lighting, daylight, sound, indoor sense of coherence, thereby enhancing his or her coping strategies and health. Psychosocially supportive design is not only the task for one person, but requires that the entire organisation understands the meaning of salutary management.*

PSD may offer some benefits when it is applied in healthcare facilities. It can help to reduce the anxiety and stress levels of patients, can help to decrease pain, and promote medical outcomes and quality of sleep while providing a comfortable environment (Dilani, 2008).

3.2.8. Superarchitecture Approach

The superarchitecture concept is not only sustainable but offers positive benefits for both human wellbeing and the environment, thus, it employs a combination of biophilic design and sustainable design for purpose of creating this 'super' architecture (Peters, 2017).

This design concept aims for more than minimal harm to the environment, buildings should offer assessable mutual benefit for environmental sustainability and human health and wellbeing. To create these healthy green buildings, architects should endeavour not merely to improve the recovery process, but also to enhance users' physical and mental abilities (Peters, 2017).

Peters (2017) argued that high-performing sustainable designs also offer benefits for human health and wellbeing, if some particular biophilic design principles are applied elaborately, such as: daylight, access to nature, colour, natural ventilation, noise, spaciousness, furniture and fittings and thermal comfort.

3.2.9. Sense-Sensitive Design

The goal of this approach is to create the most powerful healing environments for every individual within the healthcare facilities by focusing particularly on the five senses: sight, hearing, touch, smell and taste (Mazuch, 2017). The sense-sensitive design was formed by TH!NK, a specialist group within the practice. Mazuch (2017) explained this approach as:

> *Sense-sensitive design is a rigorous, evidence-based design approach that identifies ways in which individual sensory receptors of varied patient groups experience built environments, thereby enabling the designer to deliver optimal healing healthcare settings. Studies clearly show that elements of the internal environment such as natural light, artificial light, views, art, smell, modulation of space and form, juxtaposition of furniture, manipulation of scale, proportion and rhythm, together with sound, texture, materials, ease and flow of movement through space and time, and indoor/outdoor landscape, offer powerful healing and therapeutic benefits to varied patient groups.*

3.3. Clinical and Non-Clinical Healing Environment

It is critical to this study to understand the differences between clinical and non-clinical healing environments, as necessary settings in which patients receive different types of support. The Cambridge English Dictionary defines the term 'non-clinical' as *"(of medical work or workers) not involving the examination and treatment of ill people",* whereas the term 'clinical is defined as "*used to refer to medical work or teaching that relates to the examination and treatment of ill people"* (Cambridge English Dictionary, 2022). Starting with the current building regulations for healthcare settings in the UK, this section provides an explanation of the scope of clinical and non-clinical therapeutic environments in this study by using examples.

3.3.1. Building Codes and Standards for Healthcare Settings in the UK

In addition to the different design theories that have emerged in research and practice, it is widely acknowledged the benefits that nature can bring to our health, and knowledge in this area has successively informed regulatory frameworks and policies across countries, and most certainly in the UK. The key documents for all health buildings have been organised by the Department of Health for healthcare buildings in England as the Health Building Notes. The Health Building Notes have been arranged based on 17 core subjects and currently consist of 30 guidelines. These guidelines aim to “promote the design of healthcare facilities with regard to the safety, privacy and dignity of patients, staff and visitors” and give best practice guidance to design healthcare buildings by explaining policy, regulatory overview and design considerations for each subject (Core elements, Cardiac care, Cancer care, Mental health, In-patient care, Older people, Diagnostics, Renal care, Long-term conditions/long-stay care, Children, Young people and maternity services, Surgery, Community care, Out-patient care, Decontamination, Medicines management, Emergency care, Pathology). Apart from the NHS Constitution, this guidance followed two main legislations: *Building Regulations 2010 – regulations that govern the construction and services within buildings*, and *Health and Safety at Work etc Act 1974 – regulations that govern the working conditions within buildings. Moreover,* health and safety regulations (Health and Safety at Work etc Act 1974, Workplace Regulations 1992, Management of Health and Safety at Work Regulations 1999, The Construction Regulations 2007, Manual Handling Operations Regulations), Climate Change Act 2008, The Code of Practice on Infection Prevention and Control (HCAI, 2008) are other legislations the healthcare design needs to follow (Department of Health, 2013a, 2014).

The Core Elements provide policy and regulatory overview, strategic and master planning, and evidence-based design ideas for a therapeutic environment by explaining the design considerations and regulations. The policy advise increasing design quality since “well-designed healthcare buildings can help patients recover their health and well-being and have a positive effect on staff performance and retention”, although their content prioritises the requirements in relation to safety and suitability of premises; safety, availability and suitability of equipment; and cleanliness and infection control (Department of Health, 2014).

As expected, the guidelines highlight some points that are not only relevant to this study, but also establish minimum standards that should be met. Firstly, the material and furniture choice have to consider risk assessment and infection control protocols. Particularly, the most common safety incident, falling, was highlighted (Department of Health, 2013a, 2014). However, there is no supportive statement for natural material use, as the guidance only priortise infection control and risk assesment rather than guiding towards psycologically supportive environment design. Colour selection was advised to be thought with lighting design, and monochromatic colour selection should be avoided to ease wayfinding and reduce accidents since some people can confuse same-tone colours. Therefore, walls, floors and furniture colours should visually contrast. Moreover, wall and floor coverings have to be appropriate for easy cleaning (Department of Health, 2013a, 2013b, 2014).

The guidelines encourage natural lighting to reduce psychological problems and reduce sickness among both patients and staff. View of the outside is also recommended, however, the indication was that natural light without a view is preferable to no natural light(Department of Health, 2014).

Natural ventilation is also encouraged wherever possible considering safety and security protocols (particularly windows restrictor regulations). Although sustainability protocols encourage natural cross-ventilation for reduced carbon footprints, it may be against acoustic privacy regulations. Therefore, the designers are reminded to consider a balance with privacy requirements. The importance of building orientation design is indicated while considering noise control and natural ventilation. The use of artwork is also encouraged to assist in wayfinding along with reducing physical and emotional stress (Department of Health, 2013b, 2014).

The Health Building Notes also provide the designers with *evidence-based design ideas for therapeutic environment* guidelines, which reports evidence and general design considerations for different parts of the healthcare environments: arriving (outside), arriving (inside), circulation, waiting areas, in-patient rooms, consultation, socialising/meeting, vending areas, sanctuary (outside), toilets and washrooms, sanctuary (inside)(Department of Health, 2014).

In terms of cancer-related regulations, *Health Building Note 02-01: Cancer treatment facilities* explain general treatment steps of cancer and technical information about Chemotherapy, Radiotherapy, Surgical oncology, Emergency care, In-patient care, and necessary spatial organisation considerations for these environments. The guidelines recommend the project teams to get an insight into all users before the start of the design process. In relation to the quality of the environment, some important features are recommended, such as "external views and access to gardens where possible; positive distractions, for example with interesting artwork; the ability to control temperature locally (some patients are very sensitive to temperature), especially in the treatment suites; control over noise and lighting; and control over privacy" (Department of Health, 2013c).

Also, the guidelines recommended to all cancer services to adopt the Macmillan Quality Environment Mark (MQEM), a certification system designed by Macmillan Cancer Support to assess the quality of the environment and physical space with patient experience in cancer facilities (Department of Health, 2013c; Macmillan Cancer Support, 2015). MQEM identifies five main principles for cancer care environments: Accessibility, Privacy and dignity, Comfort and well-being, Choice and control, and Support. In order to assess these principles, the accreditation system follows a 14-step assessment process. Some of the assessment criterion show relevance with biophilic design parameters and natural elements: Privacy and refuge, access to natural light, good quality artificial light design, contributing to their sense of comfort and wellbeing with colour and artwork, having access to attractive outdoor and natural spaces, having control on noise levels, light, temperature and climate in the spaces, preventing unpleasant odours, etc (Macmillan Cancer Support, 2015).

In summary, since the nature of these guidelines mainly focuses on safety, security, and infection control, environmental psychology and, in particular for this thesis, the inclusion of natural elements was considered as a secondary topic. Current standards do not specialise in biophilic design and do not indicate biophilic parameters directly but use biophilic values as criteria among the many other non-biophilic features. It can be observed that the guidelines highly encourage the inclusion of natural light, view, natural ventilation, access to natural spaces and outdoor environments, privacy and feeling of refuge, and creating a sense of welcome. Although there is some exceptional specific guidance (i.e. designers should prefer natural light over view, if not possible to employ both of them in the design), these recommendations did not reflect a clear order of importance and emphasis on the minimum application requirement as my position defends these biophilic parameters should be involved in the design together harmoniously to provide the best therapeutic environmental conditions, otherwise, the application in design practice is also missing important parameters in terms of biophilic design.

Although the building standards are highly developed and human-centred in the UK, examples of psychologically and emotionally non-supportive healthcare environments can frequently be observed. The following sections exemplify both undesirable and successful examples of the current condition of therapeutic architecture in the UK.

3.3.2. Clinical Therapeutic Environments

Clinical therapeutic environments in this study refer to the places where the patients received medical treatment and examination by medical workers such as hospitals, cancer centres, medical clinics, and so on. However, the main focus to examine clinical settings are from a cancer patients' perspective, since this population visit these environments on a regular basis, and face psychological wellbeing problems frequently.

Figure 3-1: General current state of the modern hospitals in the UK.

As stated before, Charles Jencks, architect and co-founder of Maggie's Centres, described today's healthcare facilities as factory-hospitals, where the relevant medical and technical resources are dedicated to mass health (Jencks, 2017). Therefore, today still many environmentally poor healthcare facilities can be observed across the UK, although the number of patient-centred good examples has been increasing. This study examines clinical environments in the scope of different spaces within the current state of clinical healthcare settings, which were grouped in the 'Architecture for Healthcare book by Andrea Boekel (Boekel, 2007): Foyer and reception areas (Figure 3-1a), waiting areas (Figure 3-1b), nurses' station and staff break areas (Figure 3-1i), corridors (Figure 3-1g), diagnostic, surgical, and recovery areas (Figure 3-1 c, e, f), patient rooms (Figure 3-1d, h), cafeteria facilities (Figure 3-1j).

As explained in section 3.1, many studies have confirmed that patients who are diagnosed with cancer and are undergoing treatment may experience high levels of psychological discomfort, with much experiencing fatigue, anxiety or depression. Research has also shown that the built environment has an important effect on health, well-being, anxiety, depression, emotional distress and other mental health issues directly and indirectly. Therefore, in order to have a break from the poor quality of the 'factory hospitals', Jencks' vision for Maggie's Centres confirmed the need for non-clinical, human-centred therapeutic environments, as the main driver of their design agenda (Jencks, 2017). Along with the non-clinical settings developments (See 3.3.3), clinical settings can also be improved with natural processes.

In order to decrease a 'hospital feeling' and promote users' well-being, some practices aimed to create homely comfortable spaces in their hospital designs by including biophilic elements into the environment. In order to give an insight into this practice trend, the following three examples show some of the current transformations in clinical healthcare settings in the UK in this direction. These examples were selected due to their outstanding biophilic values, and they are used as cases in Chapter 6 where interviews with the architects are presented.

Circle Bath Hospital

Circle Bath Hospital, designed by Foster+Partners, was opened in 2009 in Bath, UK. The location was chosen in the outskirts of the city to create a better connection with the countryside feel in terms of view, fresh air and greenery. Along with the comfortable more domestic furniture choice, the design team also aimed to introduce timber as a building material, as much as possible. The atrium and big windows were used to get more light inside the building. Figure 3-2 shows the details and pictures from this hospital. Although, this hospital has not been called 'biophilic', its strong connection with natural elements, the inclusion of natural light, natural ventilation, nature views, natural material and greenery harmoniously in the space lead me to present it as an example of biophilic design healthcare facility in the UK.

Circle Bath Hospital

Architect: Foster+Partners

Location: Bath-England

Opened: 2009

Building Area: 6,367m²

Figure 3-2: Circle Bath Hospital.

Cancer Centre at Guy's Hospital

The Cancer Centre at Guy's Hospital, designed by Rogers Stirk Harbour + Partners, was opened in 2016 in London. The design aimed to change the clinical perception of the users. The designers also worked with the cancer patients to reveal their problems within the spaces. Therefore, Guy's cancer centre became the first in Europe to locate radiotherapy treatment above the ground level. The 14-storey building is vertically divided into four 'villages' and the welcoming zone. This division helped to increase wayfinding and less institutional feeling. Daylight, greenery, and natural ventilation were prominently thought of in the design process. Figure 3-3 shows detailed information and images from this centre.

Cancer Centre at Guy's Hospital

Architect: Rogers Stirk Harbour + Partners **Location:** London-England

Opened: 2016 **Building Area:** 20,000 m²

Figure 3-3: Cancer Centre at Guy's Hospital.

Similar to the previous example, this facility used many biophilic parameters harmoniously in their design; maximising natural light by building rotation, providing natural ventilation and offering easy access to the outdoor via balconies where greenery welcomes people, providing a feeling of prospect with a great view of the city, the inclusion of natural timber material and variety of colours. As stated above, this facility even introduced a radiotherapy service on the upper floor where the patients found access to daylight, which is unusual for radiotherapy departments usually located underground in hospitals. Also, the organisation of various services in different 'villages' increased the sense of welcome and wayfinding. Along with the environmental design, organisational arrangements also increase a sense of relaxation. For example, a no-reception idea was introduced in the facility, therefore, a volunteer team friendly welcomes people in the villages and helps them during their visit.

Alder Hey Children's Hospital

The Alder Hey Children's Hospital, designed by BDP, was opened in 2015 in Liverpool. Although this hospital has not been labelled as 'biophilic', the harmonious inclusion of some biophilic parameters can be a good example for future designs. The designers aimed to create a hospital that engenders well-being and raises users' spirits and quality of life by integrating the hospital with the nearby park for the therapeutic benefit of children, their families and staff. The majority of the rooms offer a park view and sufficient daylight was provided via panoramic windows. . Connection with the outdoor environment and fresh air was also provided via terraces and gardens which are equally accessible to all users. The effective inclusion of various colours and natural materials increased the biophilic value of the space. Figure *3-4* shows detailed information and images from the hospital.

Alder Hey Children's Hospital

Architect: BDP **Location:** Liverpool-England

Opened: 2015 **Building Area:** 6,367m²

Figure 3-4: Alder Hey Children's Hospital.

3.3.3. Non-Clinical Environment: Maggie's Centres Case

The scope of the 'non-clinical' therapeutic environment in this research includes places where the patients received practical, emotional and social support from trained healthcare professionals. In comparison with clinical settings, patients are not delivered medical treatments in non-clinical settings.

Having examined non-clinical environments in relation to health and wellbeing, the decision was to examine Maggie's Centres, which provide free practical, emotional and social support to people with cancer and their family and friends, following the ideas about cancer care originally laid out by Maggie Keswick Jencks.

Maggie's Centres are widely considered examples of biophilic design because of its well-defined design guidelines, where the main criteria are based on natural elements to promote the wellbeing of users(Maggie's Keswick Jencks Cancer Trust, 2015). These designs have very distinctive architecture, designed by renowned architects, and provide an alternative attitude for the image of healthcare, in which the primary intention is to promote well-being. Also, Maggie Keswick Jencks and her architect husband Charles Jencks, who were the founder of the concept (1993-1995) for the first Maggie's Centre, which was built in Edinburgh in 1996, had the ideology that architecture can help people through critical moments, and they aimed to provide a nature-connected architecture in these facilities (Keswick Jencks, 1995).

As another example of non-clinical therapeutic settings, a new initiative is taking place in the Merseyside region which is called Mersey Care Life Rooms. In this case, these facilities are focused on how to provide a community space for people with mental health issues. Life Rooms is a concept developed by Mersey Care NHS Foundation Trust, designed to provide enhanced support for the mental health and well-being of service users, carers, their families and the local community through a social model. The first Life Room was opened in Walton in May 2016, followed by Southport Life Room in May 2019, Bootle Life Room in October 2019, and Lee Valley Life Room in May 2022 (liferooms.org, 2022).

Compared to Maggie's Centres, Life Rooms reuse existing buildings, refurbished for this new purpose, so their spatial resources are more limited. However, they have exciting aspects in many cases, like the use of the buildings that are well-known buildings within the community, which might provide familiarity, closeness, a sense of belonging and pride, etc. In these initiatives, the new programme tries to be a part of the neighbourhood. Furthermore, while Maggie's Centres prioritise individual well-being, Life Rooms also focuses on social-communal well-being. Figure 3-5 shows the earliest Life Room, in Walton, which was occupied in the well-known building that used to be Carnegie Library, built in 1911. The centre's design process collaborated with the local community; therefore, the library characteristic was preserved along with a public cafeteria where everybody can pop in to have a drink to socialise. The amount of daylight, spaciousness, plants and comfortable furniture stand out as the most prominent environmental features.

Figure 3-5: Walton Life Room, Liverpool, UK.

Regarding the profound connection with biophilic design parameters, this thesis exclusively investigates Maggie's centres. The following sections examined Maggie's Architecture and Landscape Brief and reviews examples of Maggie's centre architecture.

3.3.3.1. Maggie's Architecture and Landscape Brief

> *Over the course of seven years, Maggie experienced cancer diagnosis, treatment, remission and recurrence. During that time, she took the insight and experience she had gained and transformed it into a pioneering approach to cancer care. Among Maggie's beliefs about cancer treatment was the importance of environment to a person dealing with cancer. She talked about the need for "thoughtful lighting, a view out to trees, birds and sky," and the opportunity "to relax and talk away from home cares". She talked about the need for a welcoming, reassuring space, as well as a place for privacy, where someone can take in information at their own pace* (Maggie's Keswick Jencks Cancer Trust, 2015).

The brief is a quite generic guideline that prominently draws the picture of feelings they want to convey to visitors with the design of the spaces. Emphasises the demand for spiritually raising, friendly, inviting, welcoming and safe architecture that evokes curiosity by attracting the attention of the patients just after leaving the hospital. The brief demands a building that works like a sanctuary by providing refuge from the intimidating hospital environment, while the landscape of the centre allows the visitors a bit of breathing space between the hospital life and the outside world.

As cancer patients need courage, self-confidence and resourcefulness, the atmosphere should offer a calm, inviting, encouraging and bold environment where patients also can be encouraged to make choices. Maggie’s belief proposes that even the small choices they make, such as where they want to drink coffee or choose the cushion to arrange the height of the chair, break the rigidity of the choiceless feeling of cancer.

Building a natural environment by creating a strong connection between the inside and outside spaces is a critical criterion in the brief. Prospect, refuge, and reflecting seasonal changes inside were recommended strongly to create inside-outside impact within the centres. There should be as much natural light as possible. Furthermore, indoor and outdoor planting also demanded providing a multisensory environment and privacy by filtering the view from outside.

Another important criterion of the brief is creating socialising space to take people out of the feeling of isolation. However, this socially encouraging environment should also be a possibility to withdraw and rest in privacy when needed.

The generic brief draws a general picture of a required centre atmosphere. Each centre varies in size and proportion; therefore, the client team involves in the design stages. However, all centres need to be aesthetic, domestic, and small humane buildings with a strong connection with nature and natural elements that raises the users’ spirit. The homely and domestic environment should not remind the hospital environment of what is now commonly recognised as demoralising layout with long corridors, closed doors, artificial light, smell of medicine, signposting etc.

Table 3-1 explains the general spatial requirements in Maggie's Architecture and Landscape Brief.

Table 3-1: General spatial requirements in Maggie's Architecture and Landscape Brief (Maggie’s Keswick Jencks Cancer Trust, 2015)

Space	Requirements
Entrance	The entrance should be obvious, welcoming, and not intimidating, with a place to hang your coat and leave your brolly. The door should not be draughty, so perhaps there should be a lobby
Entrance/welcome area:	We think of this as a “pause” space, in which a newcomer can see and assess what’s going on without feeling they have to jump right in. The first impression must be encouraging. There should be somewhere for you and a friend or relative to sit, a shelf with some books and an ability to assess, more or less, the layout of the rest of the building.
Office:	The office space should be discreet but positioned so that a member of staff working at

	their desk can spot somebody new coming in to the Centre, (there will be no reception desk). There should be generous storage room for stationery and leaflets. Space will be needed for a photocopier, printer, server etc. Each of the three main workstations needs a telephone, computer point and light, shelf and drawer space. As well as the main ones there should be six smaller workstations.
Kitchen:	The kitchen area should have room for a large table to seat 12 and is usually the main hub of the building. A fairly large “island” with additional seating for two or three people is essential for nutrition workshops, and extra space for setting up food or drinks. You need to be able to move around the table, and between it and the island. The layout of the kitchen should encourage people to help themselves to tea and coffee. We need ideally two dishwashers (or one large and one small), a large fridge or two smaller ones, one and a half sinks, an oven and a hob.
Computer desk:	We need two computer areas for people visiting the Centre who want to access information online, and these need to be within shouting distance of the office area for help if needed…the two areas don’t have to be side by side.
Notice board:	There should be space for a notice board to include fundraising and programme messaging – somewhere subtle, not too “in your face” but visible.
Library:	A place to find books and information and be able to sit and look at them comfortably. Some part of the library needs to have shelving for leaflets and booklets. This space could well be integrated with the “pause space” or an extension of it.
Sitting rooms:	We need three “sitting rooms” which can be shut off from each other or opened up depending on how they are to be used: 1. The first large room will be used for relaxation groups, t’ai chi, yoga, lectures or meetings and should provide space sufficient to accommodate 12 people lying down and storage room for folding chairs and yoga mats. It also needs to be able to store table(s) for up to 10 people. A flexible space with options to provide more or less privacy would be helpful. The noise from the main hub area of the building needs to be buffered…it doesn’t have to be completely sound-proof. It helps if this room is contiguous to the kitchen area, so that it is also possible to have fundraising events there. 2. The second medium-to-large-sized room will be used for workshops and sessions, and needs a table able to seat 12 people, which could be permanent or easy to assemble and store. This room doesn’t have to be completely sound-proof either, but should be able to be private and not to be looked in on. 3. A third smaller sitting/counselling room for up to 12 people with a fireplace or stove which doesn’t have to be very big - it makes for a friendlier atmosphere if people have to budge up a bit.
Consultation rooms:	Two small rooms used for counselling or therapy, these need windows looking out to grass/trees, or at least a bit of sky. One of the rooms should be able to take a treatment bed. Both should be sound-proof and private when in use, but could be open when not in use.
	Toilets: Two toilets with washbasins and mirrors, which should be big enough to take a chair and a bookshelf and one of them must have disabled access. They must be private enough to cry. They must be nice places; they should NEVER have gaps beneath the doors.
Retreat:	A very small quiet space to have a rest or a lie down would be good.
Views out:	It is important to be able to look out and even step out from as many of the internal spaces as possible even if it is only into a planted courtyard. Planting works well here too. It not only gives a focus to look out at, it can filter privacy in a room with glass doors or windows to the outside. We want the garden, like the kitchen, to be a space for people to share and feel refreshed by.
Views in:	The interior shouldn’t be so open that people feel watched or unprotected.
Parking:	Most projects require some parking spaces.

3.3.3.2. Existing Centres and architectural features

Maggie’s Cancer Trust has 24 centres across the UK (Aberdeen, Barts – London (City & East), Cambridge, Cardiff, Cheltenham, Dundee, Edinburgh, Fife, Forth Valley, Glasgow, Highlands, Lanarkshire, Manchester, Newcastle, Nottingham, Oldham, Oxford, Royal Free, Royal Marsden, Southampton, Swansea, West London, Wirral, Yorkshire), and three international centres (Hong Kong, Tokyo, Kalida Barcelona) (Table 3-2). Also, Maggie's centres in Northampton, Coventry, Bristol, Preston, Norway, and the Netherlands are currently (2022) in development and will start to be in service in near future. This study focused on various centres which were examined by the previous researchers from different perspectives in Chapter 5, while Chapter 6 focused on six particular centres (Forth Valley, Manchester, Newcastle, Nottingham, Southampton, and West London). The selected centres presented various features: either located in a crowded urban environment or more rural countryside; lower budget and more expensive centres; employed special materials; aimed to attract more males; and so on. The presented examples were selected from different period centres from 2001 to 2019.

Table 3-2: Operating Maggie's Centres (September, 2022) (maggies.org).

Centre	Image	Designer	Location	Year	Key Features
Aberdeen		Snøhetta	Aberdeen / Scotland	2013	Shelf form aimed to create a sense of refuge.
Barts		Steven Holl Architects	London / England	2017	No Garden, but provides rich daylight in a dense urban context.
Cambridge					No purpose-built building.
Cardiff		Dow Jones Architects	Cardiff / Wales	2019	Reflects the domesticity of the neighbouring streets.
Cheltenham		Sir Richard MacCormac	Cheltenham/ England	2010	Combination of a restored Victorian house and a modern extension.

Dundee		Frank Gehry	Dundee/ Scotland	2003	The first new-build Maggie's Centre. Modelled on traditional Scottish cottage style.
Edinburgh		Richard Murphy Architects	Edinburgh / Scotland	1996	The first centre. A redevelopment of the old stable blocks. Traditional Scottish stonework was applied together with modern methods.
Fife		Dame Zaha Hadid	Fife/ Scotland	2006	Particular on natural light and view through glass façade. Black coal emulated form represents local old mining community.
Forth Valley		Garber & James	Larbert/ Scotland	2017	Near a loch, in a rural context.
Glasgow		Rem Koolhaas, OMA	Glasgow/ Scotland	2011	Located among the woodland in the grounds of the Hospital. The interlocking rooms to flow into one another while still remaining separate.
Highlands		David Page and Brian Park	Inverness/ Scotland	2005	Spiral shapes dominate the garden, with the grassy mounds and gravel shapes mirroring and complementing the shape of the building.
Lanarkshire		Reiach and Hall	Lanarkshir e/ Scotland	2014	the creation of a matrix of courtyards that result in a porous building.

Manchester		Foster + Partners	Manchester/ England	2016	Timber structure enriched with glass surfaces. A glass house inspired from greenhouse idea.
Newcastle		Ted Cullinan	Newcastle / England	2013	The man-friendly centre. A successful combination of concrete and timber material.
Nottingham		Piers Gough	Nottingham/ England	2011	Elevated to contact with greenery. Located in a woodland.
Oldham		Alex de Rijke	Oldham/ England	2017	Thermally treated tulipwood material.
Oxford		Wilkinson Eyre	Oxford/ England	2014	The concept is based around a treehouse.
Royal Free		Daniel Libeskind	London/ England		No purpose-built building yet. The new building is under construction.
Royal Marsden		Ab Rogers Design	London/ England	2019	Comprises four volumes, clad in red glazed extruded terracotta, and is set in an idyllic garden.
Southampton		Amanda Levete	Southampton/ England	2021	Offers glimpses and views of nature and provides privacy, as well as places to come together as a group by moveable walls.

Swansea		Kisho Kurokawa with Garbers & James	Swansea/ Wales	2011	Its cosmic whirlpool shape reminiscent of the Milky Way, and this evokes an inspirational and uplifting feeling.
West London		RSH+P	London/ England	2008	The idea was to try to minimise the overbearing impact of Charing Cross Hospital.
Wirral		HB Architects	Merseyside/ England	2021	In a more rural context.
Yorkshire		Heatherwick Studio	Leeds/ England	2019	Porous materials such as lime plaster help to maintain the internal humidity of the naturally-ventilated building.
Hong Kong		Frank Gehry	Hong Kong/ China	2013	The first Maggie's Cancer Caring Centre outside of the UK. References to vernacular therapeutic architecture
Tokyo		Cosmos More	Tokyo/ Japan	2016	References to vernacular architecture
Kalida		Benedetta Tagliabue	Barcelona / Spain	2019	Compatible with surrounding heritage hospital buildings.

Maggie’s Forth Valley

Maggie’s Forth Valley, designed by Garber & James, opened in 2017 on the grounds of Forth Valley Hospital in Larbert- Scotland. The centre is located on the shore of Larbert Loch which encouraged contact with nature within the centre. The rural location is also another contributor to introducing biophilic design more effectively. Figure 3-6 shows detailed information and images from the centre.

Maggie's Forth Valley

Architect: Garber & James **Location:** Larbert-Scotland

Opened: 2017 **Building Area:** 269 m^2

Figure 3-6: Maggie's Forth Valley.

Maggie's Manchester

Maggie's Manchester, designed by Foster+Partners, opened in 2016 on the grounds of the Christie Hospital in Manchester. The centre is located in a residential neighbourhood away from traffic noise. The glass house and garden design aim to encourage users to be involved in growing plants. The inclusion of daylight, plants and timber structures are the most salient features of the centre. Figure 3-7 shows detailed information and images from the centre.

Maggie's Manchester

Architect: Foster+Partners **Location:** Manchester-England

Opened: 2016 **Building Area:** 500m²

Figure 3-7: Maggie's Manchester.

Maggie's Newcastle

Maggie's Newcastle, designed by Cullinan Studio, was opened in 2013 on the grounds of Freeman Hospital in Newcastle upon Tyne. The design team aimed to increase the male user population because the statistics showed that one-third of the users were male. Therefore, material choice, facilities and the programme of the design reshaped the user population. Figure 3-8 shows detailed information and images from the centre.

Maggie’s Newcastle

Architect: Cullinan Studio **Location:** Newcastle upon Tyne -England

Opened: 2013 **Building Area:** 300m²

Figure 3-8: Maggie’s Newcastle.

Maggie’s Nottingham

Maggie’s Nottingham, designed by CZWG Architects, was opened in 2011 on the grounds of Nottingham City Hospital. The location was chosen inside the woods with grown trees in order to strengthen the connection with natural elements. The elevation from the ground level that creates a visual connection with tree leaves is the most prominent feature of the design. Figure 3-9 shows detailed information and images from the centre.

Maggie's Nottingham

Architect: CZWG Architects

Location: Nottingham-England

Opened: 2011

Building Area: 360m²

Figure 3-9: Maggie's Nottingham.

Maggie's Southampton

Maggie's Southampton, designed by AL_A, opened in 2021 on the grounds of Southampton General Hospital. The allocated location was a corner of the car park area where the design team intervened in the topography to create an isolated quiet environment with a sense of nature. Ceramic and stainless steel was used in a novel application method that increased nature perception. Figure 3-10 shows detailed information and images from the centre.

Maggie's Southampton

Architect: AL_A **Location**: Southampton-England

Opened: 2021 **Building Area:** 360m²

Figure 3-10: Maggie's Southampton.

Maggie's West London

Maggie's West London, designed by Rogers Stirk Harbour + Partners, was opened in 2008 on the grounds of Charing Cross Hospital in London. The centre is located at the junction between Fulham Place Road and St Dunstan's Road, which are quite busy lines in a highly urbanised area. Landscape and building design aimed to create an environment which is as quiet as possible. Maggie's West London is the first Maggie's Centre in England

and one of the earliest centres, therefore, its design inspired many other centres' designs approach. Figure 3-11 shows detailed information and images from the centre.

Maggie's West London

Architect: Rogers Stirk Harbour + Partners **Location**: London-England

Opened: 2008 **Building Area:** 370m²

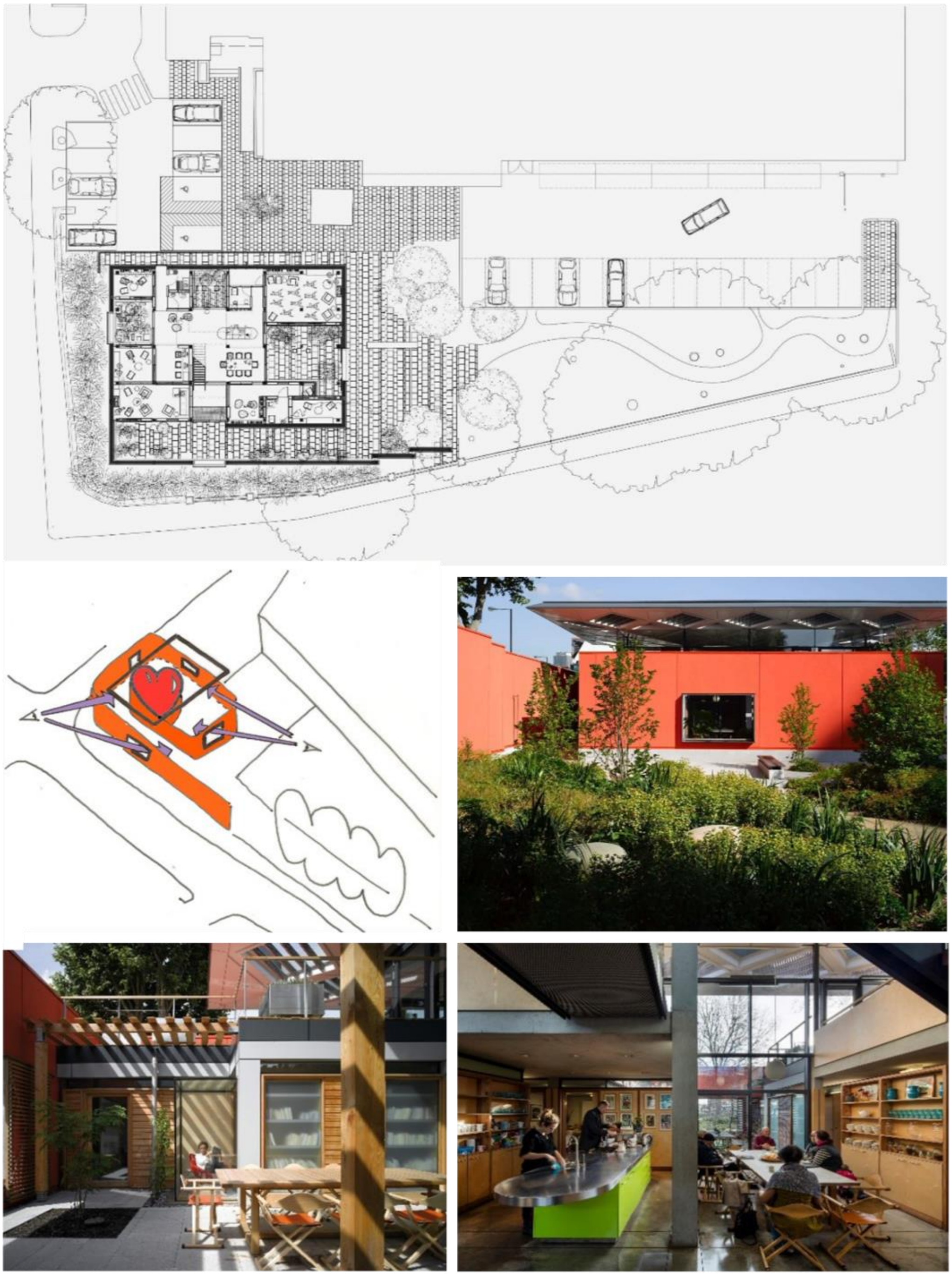


Figure 3-11: Maggie's West London.

In order to understand spaces for cancer, it is important to have an insight into the cancer illness, its treatments and side effects and the problems patients faced. Thus, the following section discusses cancer, problems and side effects of cancer and chemotherapy, psychological and socio-economic perspectives, and design principles for cancer settings from some architectural companies.

3.4. Cancer: Statistics, Effects, Problems and Approaches

Cancer is the second most common reason for death in the world (Adler & Page, 2008; Fitzmaurice et al., 2018; Tabuchi, 2020). Statistics show that three million people have cancer in the UK and this number is projected to be 5.3 million by 2040 (Macmillan Cancer Support, 2022). In 2019, 391,000 people were diagnosed with cancer, and 167,000 people died of cancer in the UK, however, it was also reported that numbers have less dramatically increase over the last decade (Macmillan Cancer Support, 2022).

Cancer treatment follows a combination of chemotherapy, radiotherapy and surgery, and the treatment process may take years where the patients have to attend clinics regularly (Adler & Page, 2008; Morishita & Tsubaki, 2017). Along with physical problems, the diagnosis of cancer also brings psychological and social problems (Adler & Page, 2008; Mehnert et al., 2014; Mitchell et al., 2011; Singer, 2018; Singer et al., 2010). Diagnosis of cancer is a quite traumatic event which usually shocks the patients (Chua et al., 2018), and they link their illness with stigmatisation, loss of control, intense pain, and death (Singer, 2018). Recent research showed that majority of the cancer patients reported that the mental health consequences of cancer diagnosis are worse than the physical effects of cancer (Bevan & Wilson, 2022a). Therefore, about 30% of the patients face mental health problems during cancer treatment (Mehnert et al., 2014; Mitchell et al., 2011; Singer, 2018), and depression, anxiety, and adjustment disorders are the most often diagnosed conditions(Adler & Page, 2008; Singer, 2018). Depressed or anxious people have lower social functioning, more disabilities, and overall functional impairment than people who are not affected by these conditions. Stress and anxiety also cause other extra problems such as pain, fatigue, and sleeping problems as well as promote unhealthy behaviours such as smoking, drinking alcohol or overeating (Adler & Page, 2008). As with other chronic illnesses, cancer can generate fear, anger, guilt, confusion, feelings of loss of control, and sadness (Adler & Page, 2008; Stanton et al., 2007).

In parallel with the literature review, grey literature was scanned narratively in January 2020 in the scope of this thesis before starting the systematically searched review (see

Chapter 4), to gain insight into relevant keywords for healing environments and cancer-related well-being problems. The grey literature review focused on reports published by cancer trusts and NHS online sources. The common problems stated by patients and professionals were listed and the researcher (with support from the Psychology Department) classified the prominent problems in groups to decide on the most extensive keywords. Hereby, the main issues people with cancer confront were depression and anxiety (Howells et al., 2019; Macmillan Cancer Support, 2019; Maggie Keswick Jencks Cancer Trust, 2018a, 2018b, 2019a, 2019b, 2020a, 2020c, 2020b, 2021). Table 3-3 shows the classification of all keywords identified in the grey literature review.

Table 3-3: Common well-being problems of patients with cancer.

1-Depression	**2-Anxiety**	**3- Other feelings**	**4-Other Problems**
Anhedonia	Uncertainty	Emotional distress	Chemo Brain
Lose of the joy of living	Fear	Confusion	Difficulty concentrating
Loss of interest in activities	Changeable emotion	Loss of sense of belonging	Difficulty remembering
Grief	Adjustment disorder	Resilience and coping	Changes in sleep
Guilt		Sense of respite	Changes in appetite
Irritability		Isolation	Increasing interest in alcohol
Feeling down		Feeling alone	Upset stomach
Hopelessness		Loss of independence	Panic attacks
Worthlessness		Paranoia	
Anger		Worry	
Sadness		Loss of energy and motivation	
Loss of self-esteem		Suicidal thoughts	

Based on the existing literature, Cankurtaran (Cankurtaran, 2020) listed briefly the factors that affect the emotional distress and mental health problems of cancer patients as follows: biological problems, side effects of medication, reactions to chemotherapy, changes in body image, lack of information or skills needed to manage the illness, loss of self-reliance, fear of suffering, confrontation with death, family members' reaction to the disease, pre-existing family problems, disruptions in work, school, and family life, death of other patients, logistic and financial problems, and personality factors.

Moreover, psychological distress after diagnosis can be severe and may result in clinically relevant mental health conditions (Singer, 2018). Apart from the patients, their family and friends also spend a lot of time and energy while supporting them and they can also suffer from mental health conditions (Adler & Page, 2008; Mehnert et al., 2010). Socioeconomic condition also affects the treatment and recovery process. It is widely accepted that low socioeconomic status is linked to both poor health and restricted access to healthcare (Arrossi et al., 2007; Mutuma et al., 2017; Singer et al., 2010), and cancer death rates were found to be higher in people with lower socioeconomic level (Tabuchi, 2020). When a patient is diagnosed with cancer, their socioeconomic status may even decline, especially if they lose their work as a result of a cancer-related impairment (Singer, 2018). After receiving a cancer diagnosis or treatment, a significant proportion of people discontinue working or change jobs (Adler & Page, 2008). Cancer & Employment Survey results showed that in the UK 25 per cent of the participants did not return to their work after completing their treatment, and 15 per cent of those who returned their work worked with a different employer. Financial problems are defined as one of the major stressors for cancer patients and their families (Bevan & Wilson, 2022a).

Cancer and chemotherapy treatment have prominent side effects that can be still experienced long after recovery. The most common problems and side-effects of the treatments that cancer patients faced are fatigue, depressed mood, appetite loss, sleep problems, muscle weakness, pulmonary dysfunction, neurological disturbances, and pain (Adler & Page, 2008; Bernhardson et al., 2008; Bevan & Wilson, 2022b; Chen et al., 2021; Goodman, 1989; Morishita & Tsubaki, 2017; T. Wang et al., 2018). Partridge et al. (2001) listed the most common short-term side-effects of chemotherapy as: emesis, nausea, stomatitis, alopecia, myelosuppression, thromboembolism, myalgias, neuropathy, fatigue; and long-term side-effects as premature menopause/infertility, weight gain, cardiac dysfunction, leukemia/MDS and cognitive dysfunction. Taste and smell changes are also frequently observed side effects of chemotherapy. Particularly, taste alteration is reported by cancer patients undergoing chemotherapy as one of the most distressing side effects together with hair loss, sleeping difficulties, vomiting, loss of appetite, fatigue and nausea (Bernhardson et al., 2008; Zabernigg et al., 2010). A self-reported research showed that 67 per cent of participants experienced taste changes while 49 per cent experienced smell changes at some point during the treatment, and more women reported smell change experience than men (Bernhardson et al., 2008).

Although cancer care design mainly focused on providing safe and practical spaces for treating the disease biomedically, cancer clinics have been considering patients' emotional and psychological needs by offering friendly, warm pleasant, more patient-focused environments (Goodm, 2003; Zeliotis, 2017). The designers of these patient-focused centres usually aim to create bright, attractive, social, accessible and homely environments that will make patients feel more normal, and help them somehow to forget challenges they faced . For example, HEAPY, one of these companies, reported their five design considerations for modern cancer centres: feeling at home by designing more spacious and cosier rooms with improved way-finding and a sense of familiarity; adaptable environment that can be controlled by the patients; privacy and dignity; designed for wellness by using appropriate HVAC systems and making use of natural light; seamless technology integration (HEAPY, 2023). The architecture company HOK's healthcare design group prioritise giving patients the ability to take some control of the environment (HOK, 2020). The Healthcare Facilities Management magazine advised designers to consider noise control, using safe material, easy wayfinding and accessible spaces which do not require long-distance walking, more privacy, a variety of furniture configurations that provide socialisation opportunities, soft seating since cancer patients lose weight, maximise natural light and views (Itani, 2015). However, above all design goals designers focus on infection control in cancer centres as one of the most crucial points of healthcare design. Designers can be involved in infection control by designing air ventilation and filtration systems, water systems, choice of material (particularly avoiding toxic materials such as benzene, asbestos, vinyl chloride, radon, and arsenic), designing self-cleaning opportunities (i.e. hand-washing sinks and antibacterial gel stations close to treatment locations), or avoiding real plants where they can be infectious for patients (Berry et al., 2020).

Cancer is an illness of the era. Scientific evidence supports that fighting stress and anxiety has a profound impact on the recovery process. Therefore, the environment can help to reduce the stress and anxiety of the inhabitants. However, the environmental perception and needs of people with cancer should be taken into account.

3.5. Concluding Remarks

This chapter gave insight into the definition and context of a healing environment with examples close to biophilia of healthcare settings in the Western culture, from ancient times to the present. Furthermore, it also presented a brief overview about the theories that propose environmental agendas to promote healing characteristics of architecture, mainly for healthcare settings. The definition of 'clinical' and 'non-clinical' notions brought clarity for further chapters of this thesis with the examples that were frequently mentioned in this research. Also, the current state of building regulations, building codes, and good and bad examples of clinical and non-clinical settings will mainly be investigated in Chapters 4, 5, and 6.

In light of the knowledge conveyed in the literature review chapters (Chapters 2 and 3), the following chapters will report the research that investigated biophilic design parameters and implementations in therapeutic environments.

CHAPTER 4

4. ASSESSMENT OF BIOPHILIC DESIGN PARAMETERS IN THERAPEUTIC ENVIRONMENTS WITH A SYSTEMATICALLY SEARCHED REVIEW

A systematically searched review of existing scholarly literature on the importance of biophilic design parameters and their impact on human health and well-being within clinical therapeutic environments was chosen as a methodology for this study. This chapter explained the systematic review methodology, its protocol, selected studies and their quality assessment, extracted data, and synthesis of the results. The goal of this chapter is to extract information from users (cancer patients and staff) to have their expectations from a therapeutic environment and to understand their perspective for the clinical environment that can also inform design recommendations in non-clinical environments.

4.1. Systematic Review Methodology

A systematic review methodology is a form of a literature review using a systematic procedure, which originally emerged to help diagnose processes of illnesses, and is prevalent in health and medicine studies (Cook et al., 1997) and tailored to different fields with its clear system to answer research questions (Kitchenham, 2004). It was defined in *The PRISMA Statement* as "A systematic review is a comprehensive review of a clearly formulated keywords of a question that uses systematic and explicit criteria to identify, select, and critically appraise relevant research, and to collect and analyse data from the studies that are included in the review", (Moher et al., 2010). Likewise, Boland et al., (2017) claimed that the best way of synthesising the findings of several studies which look for answers to the same questions is the systematic review methodology. This kind of review follows clear, well-defined and transparent steps, which offer a chance to be checked by repeating the process, and always requires: a well-defined question or problem, identification and critical appraisal of the evidence, synthesis of the findings and drawing relevant conclusions (Boland et al., 2017). Since this study in the architecture field is not able to carry out a full systematic review as in the medicine field. I will refer to the review as a 'systematically searched review' in this thesis.

Although a narrative literature review was used for this PhD research's background, in this chapter a systematically searched review was carried out instead of a narrative review to obtain quantitative scientific facts for answering the main research question and supporting the research by looking at existing research systematically. Systematic reviews are different from traditional narrative reviews in several ways. Systematic reviews contain more scientific information and produce stronger evidence (Boland et al., 2017). This methodology always requires well-defined and focused question(s) and a pre-defined search strategy, and follows a protocol and an explicit and rigorous methodology (Boland et al., 2017). In comparison to narrative reviews, the reasons for the acceptance of systematic reviews as scientific processes can be listed as (Boland et al., 2017; Cook et al., 1997; Karacam, 2013):

- Systematic reviews are more objective, less biased and more reliable.
- A systematic review is much more comprehensive and can be repeated since it is done with a certain systematic and well-defined method.
- Inclusion and exclusion criteria for sources are clearly identified.
- Bias of included result sources is evaluated by using Quality Assessment Tools.
- Peer reviews are done at some key steps for carrying out a more objective review and preventing possible bias of the main researcher.
- Even the smallest evidence is included in the compilation when extracting the data from the sources.
- The results can be confirmed anytime by repeating the proposed protocol.

The differences between the two types of reviews are collected in Table 4-1.

Although the process and steps of a systematic review methodology are the same, many researchers have classified the systematic review stages differently so far. Cook et al. (1997) listed six steps required for a robust systematic review: Question, Sources and search, Selection, Appraisal, Synthesis and Inferences. The Prisma statement developed by Moher et al. (2010), explained the protocol in four main stages: Identification, Screening, Classification and Inclusion. According to Khan et al. (2003), a systematic review consists of five main stages: Framing the question, Identifying relevant publications, Assessing study quality, Summarising the evidence, and Interpreting the findings. Kitchenham, (2004) adopted the systematic review methodology to the engineering field as three main stages: Planning the review, Conducting the review, and Reporting the review. However, the steps and methods of the process are the same for all systematic reviews as follows (Boland et al., 2017):

- Planning the review
- Identifying the review question, scoping searches, inclusion and exclusion criteria, and the protocol
- Literature searching

- Screening titles and abstracts
- Obtaining papers
- Selecting full-text papers
- Data extraction
- Quality assessment
- Analysis/Synthesis
- Writing up and editing

Table 4-1: Differences in a review process between systematic and narrative reviews (Boland et al., 2017).

	Narrative Reviews	Systematic Reviews
Defining a question	May not be clearly defined	Always required, clearly defined and well-focused
Writing a protocol	Not required	Essential
Methodology	Does not follow explicit or rigorous methodology	Follows explicit or rigorous methodology
Searching	No pre-defining search strategy Not necessarily comprehensive Generally relies on published literature Search strategies may be based on expert experience	Exhaustive and with an appropriate balance of sensitivity and specificity Carried out across a number of bibliographic databases, hand searching of reference lists from relevant papers and high-yield journals and documents. Grey literature sometimes searched Comprehensive and explicit searching methods used and reported
Definition of inclusion and exclusion criteria	Not essential No selection of studies based on study design	Essential Study design can be selected (e.g. only include qualitative data)
Screening titles and abstracts; selecting full-text papers	Generally carried out by one researcher by reading through relevant papers and based on their own experience	Explicit and systematic screening and selection, using pre-defined method Usually cross-checked by another researcher
Quality assessment	Not necessarily	Yes
Data extraction	Yes	Yes
Analysis and synthesis	No clear method of synthesis	Can involve meta-analysis, narrative or qualitative synthesis
Application	Any field	Any field
Timescale	May be carried out relatively quickly	Can be time-consuming due to rigour required
Replication	Not easily replicable	Explicit methods and therefore replicable

This systematically searched review followed the steps listed above from Boland et al. (2017) systematic review guideline. After planning the review, the following stages started with the identification of the review question.

4.2. The Review Question

Before starting the review, the research problem should be defined in the form of a simple, unambiguous and organised question or several questions (Khan et al., 2003). The research team should define the frame of the research question for which the purpose of the systematic review is established (Karacam, 2013). The question initially might be stated as a query in a free-form format. However, the question also can be structured in a more explicit way. A structured question, commonly in the fields of evidence-based healthcare, focuses on four parts: the populations, the interventions, the outcomes, and the study design (Ibid.).

In this review, the main research question of the PhD research was adopted, and it was implemented as a *free-form* review question: *Which biophilic criteria are most important in a clinical therapeutic environment and how do they inform design?*

Having set the question in a free form, the research team can modify the protocol where alternative ways of describing populations, interventions, and results or study designs arise (Karacam, 2013). Therefore, after defining the question, the systematically searched review started with establishing a frame of the search strategy in the following section.

4.3. Search Strategy, Inclusion and Exclusion Criteria

A clear search path usually suggested as an explicit protocol, is necessary for a systematic review search not to be inconsistent (Wong et al., 2013) while also being replicable. Every transaction must be recorded throughout the process to be able to reproduce it (Boland et al., 2017).

Having established the search question, the search strategy was created in accordance with the book "Doing a Systematic Review: A Student's Guide" by (Boland et al., 2017). Thus, the process and progress of this review adhere to the overall principles of this guideline, following the guideline’s systematic review steps listed in section 4.1.

First of all, a well-developed search strategy uses appropriate keywords relevant to the systematically searched review question and determines the most appropriate electronic databases for scanning. Thereafter, a search syntax should be formulated with the keywords in keeping with the database searching guidelines (as they might have some word limitations or different formulations for advanced searching). Boolean operators are preferred since they are more specific in searching within the databases (Corsini et al., 2019).

Initially, a scoping search was conducted in August 2020 to provide an overview of relevant literature and to have an insight into the selected databases, keywords, boolean codes and search fields. The databases were decided by looking at related existing systematic review studies in the field of architecture and the sources used in the narrative literature review carried out for the background sections of this thesis. Recommended databases for architects by the University of Liverpool Library were also included in the scoping search. After conducting a pilot search, six databases were selected for searching relevant published literature, through the University of Liverpool Library: Scopus, Web of Science, JSTOR, ProQuest, ScienceDirect and Ebscohost, see details in Table 4-4.

The scope of the resources was restricted to only academic journal articles in order to reduce the risk of bias as peer-reviewed publications are likely to be more reliable. In parallel with the grey literature review, explained in 3.4, depression and anxiety keywords were selected to direct and narrow down the search to reach more relevant data. It was crucial to understand the emotions and conditions accompanying cancer-related disorders, to decide which design parameters could better support their mental health.

A challenge in selecting keywords for biophilic design parameters was the lack of common terminology. It would be a cumbersome and highly time-consuming endeavour to examine each of the biophilic design parameters separately, as each of them conforms to areas of research that have been extensively investigated. On the other hand, using just global terms such as 'biophilic design' alone produced very limited results, as the biophilic design has only been recently developing as a research and practice field. Although the term `biophilic design' was not commonly used, there was abundant research related to some of the elements (parameters) that define it (synonyms or variations) (Table 4-2). Relevant disciplines in architecture (i.e. Ecological Design) were also included in the keywords to cover this limitation; thus, a number of irrelevant publications had to be eliminated during the initial abstract review step.

Table 4-2: Keyword plan.

KEY TERMS	**Biophilic Design**	**Therapeutic environment**	**Wellbeing**
Synonym Terms or Variations	Natural design Restorative design Ecological design Biophilia Biophilic Design	Healing environment Hospital Healthcare Care Centre	Depression Anxiety

Bibliographic databases provide wide-ranging and advanced searching options that allow specifying the publication's date, field, author, journal, etc. However, keywords can be addressed more associated with publications by using the combining tools known as Boolean operators (Boland et al., 2017). Boland et al. (2017) explained the main Boolean codes as follows:

- AND: Combines terms and therefore narrows the search and identifies references containing all of the words entered.
- OR: Broadens the search and identifies references containing any of the words entered.
- NOT: Used to exclude something and therefore narrows the search and identifies references that do not contain the term following it.

The basic search syntax with Boolean operators considered in this systematically searched review was: ("biophilic design" OR biophil* OR "natural design" OR "restorative design" OR "ecological design") AND ("therapeutic environment" OR "healing environment" OR hospital OR healthcare OR "care centre") AND (well-being OR depres* OR anxi*). However, these codes showed alteration depending on the search limitations of bibliographic databases. Table 4-4 shows the details of the variations in the search syntax used for each database.

Table 4-3: Inclusion and exclusion criteria.

	Inclusion Criteria	Exclusion Criteria
Population	Those who use therapeutic places regularly	Those who are not related to therapeutic environments
Nature of the Intervention	Therapeutic environment Clinical settings Healing environment Hospitals or healthcare	Retail or shopping Residential buildings Neighbourhoods or urban districts Universities or schools Workspace or Office setting
Comparators	Biophilic design parameters Biophilic variables of the biophilic design patterns	Non-biophilic elements
Outcomes	Studies that give strong insights or scientific facts to compare or rank a cluster of biophilic patterns	Studies that examine only one or an inadequate number of patterns.
Cultural / Linguistic	English	Non-English
Period	1973 to current	Pre-1973
Study Design	Empirical research Qualitative or Quantitative Any primary comparative study	News, reports and reviews
Types of Documents	Academic Journals	Editorials or commentaries News reports Magazines Book Reports or Proceedings (published or unpublished) Dissertation Thesis or Dissertation

Before starting the search, it should be determined the inclusion and exclusion criteria that draw the boundaries of the search. The determination of the inclusion and exclusion criteria should comprise all possible sources that can answer the review question. Also, the criteria should be well framed in order to not exclude useful data or include unnecessary studies (Meline, 2006). Boland et al. (2017) claimed that operative inclusion and exclusion criteria should represent criteria related to Population, Intervention, Comparators, Outcomes and Study Design. Thus, this systematically searched review determined the inclusion and exclusion criteria following this approach, as seen in Table 4-3.

The criteria for Population were connected with the studies that look at patients, staff and visitors who use these healthcare settings regularly. The Nature of the Intervention employed the cases done in healthcare environments, with a particular focus on clinical environments, while excluding the studies that examined all other typological cases (e.g., educational, residential or commercial buildings). The basic Comparator was biophilic design parameters, and all studies that gave holistically (not focused on only one or several biophilic design parameters) insight into the impact of biophilic design parameters were included in the review. Although many reviewed studies did not associate the examined environmental features with the biophilic design parameters, the reviewer and supervisory team decided to include them upon their knowledge about biophilic design and its parameters, as many of the environmental features in the studies were variations of biophilic design parameters or had deeply connected with them. The Comparator criteria led to the Outcome criteria. The review team rigorously examined the data to decide whether it was able to lead to a comparison of the parameters or indicated important environmental biophilic features. Once again, it was crucial to assess the results during the full-text reading step in this review because the details in the outcomes revealed the important biophilic design parameters as many of the studies did not indicate the parameters under the name of 'biophilic'. Thus, after reading the full text of the selected papers, the peer reviewers (supervisory team) re-read all these publications to assess which studies may give stronger insights or the most relevant scientific facts to compare biophilic design parameters.

The Study Design of selected papers was restricted to empirical, qualitative or quantitative research and any primary comparative studies aiming to obtain primary data to reveal important parameters from the users' perspective to a more objective point of view. Even though news, reports and reviews were excluded, some reviews that represented extensive insight into biophilic parameters were considered for inclusion by the reviewer. Furthermore, the systematically searched review only employed academic journal papers while editorials, commentaries, news reports, magazines, books, reports, and thesis were excluded from the search, given that the data from peer-reviewed academic journals increases reliability and reduces the risk of bias.

Table 4-4: Searching results (22.09.2020).

Date Performed	Database	Search Syntax	Number of Results
22.09.2020	Web of Science	ALL=("biophilic design" OR biophil* OR "natural design" OR "restorative design" OR "ecological design") AND ("therapeutic environment" OR "healing environment" OR hospital OR healthcare OR "care centre") AND (well-being OR depres* OR anxi*)	7
22.09.2020	Scopus	("biophilic design" OR biophil* OR "natural design" OR "restorative design" OR "ecological design") AND ("therapeutic environment" OR "healing environment" OR hospital OR healthcare OR "care centre") AND (well-being OR depres* OR anxi*)	443
22.09.2020	JSTOR	(("biophilic design" OR biophil* OR "natural design" OR "restorative design" OR "ecological design") AND ("therapeutic environment" OR "healing environment" OR hospital OR healthcare) AND (well-being OR depres* OR anxi*))	145
22.09.2020	Ebscohost	("biophilic design" OR biophil* OR "natural design" OR "restorative design" OR "ecological design") AND ("therapeutic environment" OR "healing environment" OR hospital OR healthcare OR "care centre") AND (well-being OR depres* OR anxi*)	70
22.09.2020	ProQuest	("biophilic design" OR biophil* OR "natural design" OR "restorative design" OR "ecological design") AND ("therapeutic environment" OR "healing environment" OR hospital OR healthcare OR "care centre") AND (well-being OR depres* OR anxi*)	402
22.09.2020	ScienceDirect	((biophilic" OR "natural design" OR "restorative design" OR "biophilic design") AND ("therapeutic environment" OR hospital) AND (well-being OR depres OR anxi))	28

Having done the scoping search, the main search was conducted in September 2020 on the six databases selected. The language was limited to only English, and the searching period was defined by the starting date of 1973, which is when Fromm coined the term biophilia and established it as a general concept, to the search time (September 2020). A total of 1,095 publications were exported to Rayyan QCRI, a systematic review software developed by the Qatar Computing Research Institute, which helps accelerate the initial screening of abstracts and titles using a semi-automatised process (Ouzzani et al., 2016). Although the software Covidence and EPPI-Reviewer were also examined, Rayyan QCRI software was selected for this review due to its advanced interface that offers easier data compilation and arrangement through an open-access system. Table 4-4 shows the search records and number of results exported for screening in the next stage.

Table 4-5: Searching results (26.09.2021).

Date Performed	Database	Search Syntax	Number of Results
26.09.2021	Web of Science	ALL=("biophilic design" OR biophil* OR "natural design" OR "restorative design" OR "ecological design") AND ("therapeutic environment" OR "healing environment" OR hospital OR healthcare OR "care centre") AND (well-being OR depres* OR anxi*)	3
26.09.2021	Scopus	("biophilic design" OR biophil* OR "natural design" OR "restorative design" OR "ecological design") AND ("therapeutic environment" OR "healing environment" OR hospital OR healthcare OR "care centre") AND (well-being OR depres* OR anxi*)	3
26.09.2021	JSTOR	((biophilic" OR "natural design" OR "restorative design" OR "biophilic design") AND ("therapeutic environment" OR hospital) AND (well-being OR depres OR anxi))	0
26.09.2021	Ebscohost	("biophilic design" OR biophil* OR "natural design" OR "restorative design" OR "ecological design") AND ("therapeutic environment" OR "healing environment" OR hospital OR healthcare OR "care centre") AND (well-being OR depres* OR anxi*)	6
26.09.2021	ProQuest	("biophilic design" OR biophil* OR "natural design" OR "restorative design" OR "ecological design") AND ("therapeutic environment" OR "healing environment" OR hospital OR healthcare OR "care centre") AND (well-being OR depres* OR anxi*)	83
26.09.2021	ScienceDirect	((biophilic" OR "natural design" OR "restorative design" OR "biophilic design") AND ("therapeutic environment" OR hospital) AND (well-being OR depres OR anxi))	11

Screening and selection of the papers explained in the following section, took quite a long time since the whole team reviewed the papers individually. Moreover, COVID-19-related restrictions affected other parts of the PhD research, thus, the research team had to adjourn the review for a while. For all reasons above, a second search was conducted on 26.09.2021 in order to keep the review updated (Table 4-5). The second search followed the same protocol and was conducted in the same databases, but the publishing date was restricted to the period from September 2020 to the search date (26.09.2021). A total of 106 new publications were exported to Rayyan QCRI.

4.4. Screening and Selection

The application of inclusion and exclusion criteria requires two stages: screening titles and abstracts, and screening and selecting full-text publications (Boland et al., 2017). The next steps in the process after having extracted the sources were listed by Boland et al. (2017): de-duplicating references, developing a screening and selection tool, screening all titles and abstracts taken into account the inclusion and exclusion criteria, obtaining the full-text papers for final selection and identifying the included eventual publications.

Some scholars recommend the use of the Mendeley software as the best for de-duplicating bibliographic software (Kwon et al., 2015). As a systematic review software, not a bibliographic software, Rayyan QCRI provides a de-duplication tool as well. For obtaining the most reliable results, both software, Mendeley and Rayyan QCRI, were used for removing duplicated documents, and both of them showed equal quality control and removed the same duplicates from the pool of collected studies. After removing 156 duplicates via Rayyan QCRI, 37 other duplicates were detected and deleted manually during the initial screening.

The reviewer initially screened all the titles and abstracts in accordance with the inclusion and exclusion criteria detailed in Table *4-3*. The systematic review methodology denominates the process of screening abstracts and titles as “initial review” (Boland et al., 2017). Therefore, the initial review in this study was repeated five times to ensure that the requirements had been successfully employed. During the first three phases, 861 publications were excluded, of which 168 papers were irrelated reviews and systematic reviews, and five papers were published in foreign languages, 688 papers were about irrelevant fields and topics to this review, including urban, horticultural and animal-assisted studies even though they were relevant to biophilic design elements. In the fourth screening, seven more papers were excluded due to their non-holistic approaches to specific biophilic elements. In the last phase of the process, the final 34 articles were screened by the peer reviewers as well as the reviewer to ascertain the final decision on which sources should be included or excluded. After this, 16 publications passed to the next stage, full-text reading, where the reviewer and the peer reviewers read these publications separately to provide objective and independent results. Five other publications from external sources were included in this stage so the total number of sources that reached this stage was 21. The reviewer examined the full texts of these 21 documents separately to reduce the risk of bias. After having selected the final papers from full-text reading separately, the team decided on the final included papers by matching their individual selections and explaining the reasons for inclusion. Finally, seven papers were included in the systematically searched review throughout a systematic search process.

The second review was carried out in September 2021 following the additional search explained in the previous section. The same procedure was followed throughout the new review (Figure 4-1). Firstly, four duplicates were removed and initial screening was done with 98 documents where only four articles were selected for full-text examination. The reviewer decided on including two more studies in the systematically searched review. The data extraction and analysis began with the final nine studies.

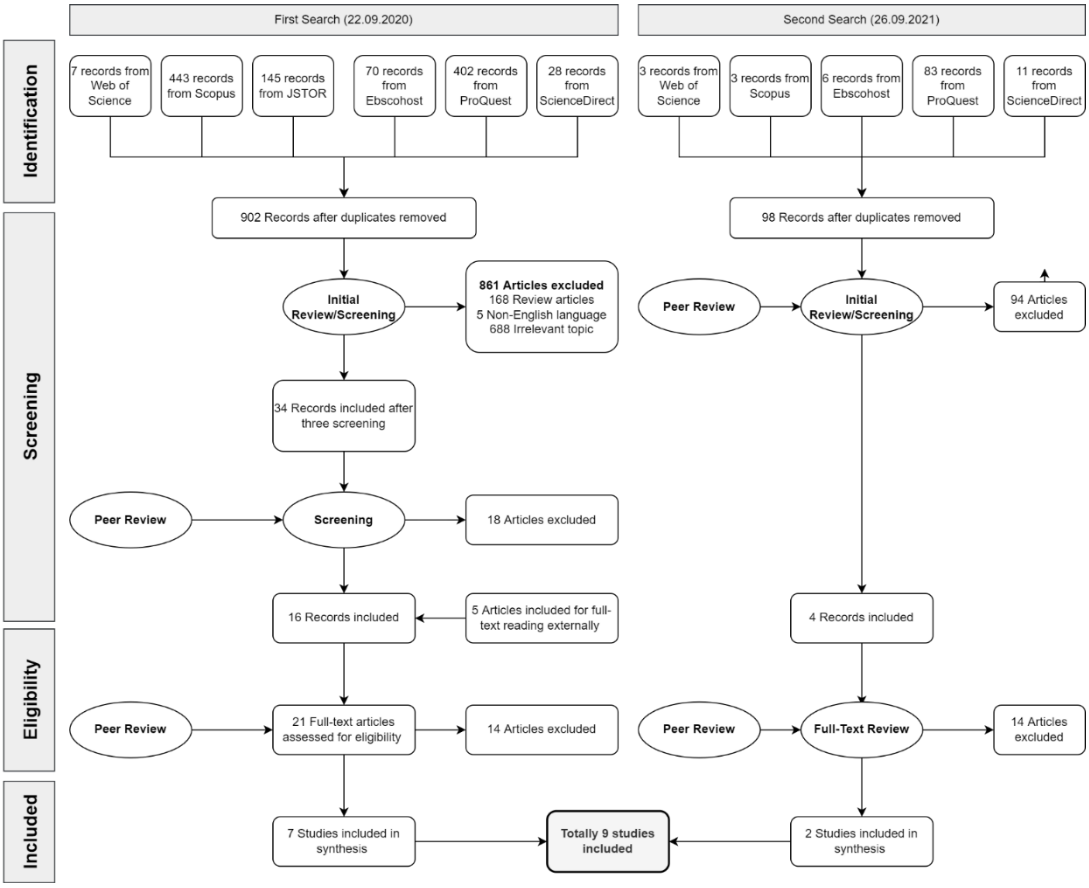


Figure 4-1: Identification of included articles in the systematically searched review.

4.5. Data Extraction and Analysis of the Selected Studies

After having selected the included studies, the next step is to identify and extract relevant data from each individual study. Data extraction is a process of extracting relevant data from the included papers and storing them in a single format (Boland et al., 2017). It is advised to use a single format of form or table to extract data. However, the analysis of papers and the data extraction for this particular systematically searched review followed individual methods for each study because all studies used divergent methodological approaches. Another reason was the extracted data (biophilic design parameters) were referred to in a wide range of definitions as predicted in the light of the greater research gap of this PhD study “there is no standardised framework about biophilic design parameters”.

Table 4-6: General overview of the included studies.

Study	Reference	Method	Participant number	Population /Context	Contribution to the Review
1	(Blaschke et al., 2018)	Qualitative	20	Patient/Oncology	Inpatient / Clinical
2	(Wiltshire et al., 2020)	Qualitative	18	Cancer Patients	Outpatient/ Clinical
3	(Blaschke et al., 2017)	Quantitative	38	Experts/Oncology	Inpatient/ Clinical
4	(Peditto et al., 2020)	Quantitative	104	Young Cancer Patient Facilities	Inpatient/ Clinical
5	(Tinner et al., 2018)	Quantitative	72 Staff, 62 Patient	Staff and Patient/ Cancer Centre	Staff, Outpatient/ Clinical
6	(Putrino et al., 2020)	Quantitative	496	Frontline Healthcare Workers/ COVID-19	Staff/ Clinical
7	(Nejati et al., 2016)	Mixed	10 Interviews, 993 Surveys	Professional Nurses and Healthcare Workers	Staff / Clinical
8	(Abdelaal & Soebarto, 2019)	Mixed method review	NA	Patients	Inpatient and Outpatient/ Clinical
9	(K. Tanja-Dijkstra & Andrade, 2018)	Review-Mixed	Case 1: 62 Survey	Cancer Patients	Outpatient and Inpatient / Clinical

Table 4-6 summarises the general overview of the selected studies. Study 1 and Study 2 were qualitative studies, the data extraction followed a second analysis of the statements and facts reported in these studies by using Nvivo 12 software, a tool to support qualitative analysis by organising and visualising unstructured or semi-structured data through a system of codes (NVIVO, 2012).

Study 3, Study 4, Study 5 and Study 6 represented quantitative data from different groups of participants. Finally Study 7, Study 8, and Study 9 employed mixed methods. All studies contributed to the goal of the systematically searched review from both patients' and staff’s perspectives. Detailed information about the publications was presented in the following sections along with the data extracted.

Table 4-7 shows the background information about the included studies. All nine studies were published between 2016 and 2020. Four of the studies were conducted in the United

States, three in Australia, one in the United Kingdom, with one study co-conducted between the UK and the Netherlands. Five of the studies were published by health and/or medicine-related authors, two studies were published by academics in environmental disciplines and two were conducted by academic architects. Additionally, the majority of the publications (seven) were focused on cancer care settings.

Table 4-7: Background information of the included studies.

Study	Country	Year	Field
1	Australia	2017	Faculty of Medicine
2	UK	2020	Department for Health,
3	Australia	2017	Faculty of Medicine
4	USA	2020	Dept. of Design and Environmental Analysis,
5	USA	2018	Department of Forest and Natural Resources Management,
6	USA	2020	Department of Rehabilitation and Human Performance
7	USA	2016	Department of Architecture
8	Australia	2019	Department of Architecture
9	Netherlands-UK	2018	Department of Clinical, Neuro and Developmental Psychology

4.5.1. Study 1: Cancer Patients' Recommendations for Nature-Based Design and Engagement in Oncology Contexts: Qualitative Research

'Cancer Patients' Recommendations for Nature-Based Design and Engagement in Oncology Contexts: Qualitative Research' was published in Health Environments Research & Design Journal in 2018 by Sarah Blaschke, Clare C. O'Callaghan and Penelope Schofield.

The main objective was to explore cancer patients' recommendations for nature engagement in cancer settings based on their experiences, and to gain insight into nature-based design in an oncology context. The research used a qualitative methodology that employed semi-structured interviews with diagnosed cancer patients. Twenty interviewees were selected heterogeneously in diverse sample groups in terms of age, gender, diagnoses, and treatment status like inpatients, outpatients and who had completed treatment in order to obtain a rich variety of data. The participants were required from an Australian tertiary cancer hospital; however, the hospital was anonymised and no detailed information about the environmental features was defined. The interview presented in this publication sought answers to the following two questions from participants: *what are their nature-based environmental recommendations for other cancer patients, and what is their advice for nature-based opportunities in cancer settings?*

The paper analysed and investigated the results in two main contexts, recommendations and cautionary advice. Recommendations were compiled and presented on the basis of natural features and functions in the cancer settings (Table 4-8). The interviewees defined possible useful environmental changes to enhance contact with natural features in cancer settings: views to nature, natural design features (except water), contact with water specifically, animals, and nature art. They also described some beneficial functions as outcomes of engagement with natural features for cancer treatment along with the usual clinical actions: Providing desired levels of engagement (sensory and private), Promoting physical activity, Events, entertainment and activities, Helpful mental activities and techniques for distraction and social opportunities, and Healthcare service integration and expansion.

Table 4-8: Cancer Patients' Nature-Related Recommendations and Cautionary Advice (Revised version based on number of informants for each statement).

Recommendation features		**Recommendation functions**		**Cautions**	
Views to nature	12	Desired engagement (sensory and private)	13	Appropriateness	7
Natural design features (other than water)	10	Physical activity promotion	11	Safety	6
Contact with water specifically	9	Events, entertainment, and activities	7	Allergies	4
Animals	5	Accompanying clinical procedures	6	Healthcare investment	3
Nature art	3	Helpful mental activities and techniques	6	Negative trigger	3
		Social opportunities	6	Overwhelm	3
		Healthcare service integration and expansion	2	Sensory overstimulation	3
				Not valued/not interested	1

The paper highlighted only three of the featural and functional items as the most important of all since they were recommended by more than half of the participants; desired engagement (sensory and private) (n=13), views to nature (n=12), and physical activity promotion (n=11). However, the portion of 'Natural design features (other than water)' should not be disregarded because half of the participants (n=10) recommended it. The fact remains that the study examined the natural design features in two different titles by separating 'Contact with water' which was also asserted by nine participants. A holistic point of view combined two titles by calculating how many different interviewees recommended either of them featured the 'Natural design features' title with a total of 14 recommendations.

In order to have a deeper insight into the recommendations and to extract their references to the biophilic design parameters in more detail, the key terms and phrases used by study participants were analysed in NVIVO 12 software. Figure 4-2 showed the correlation between recommendations and biophilic design parameters.

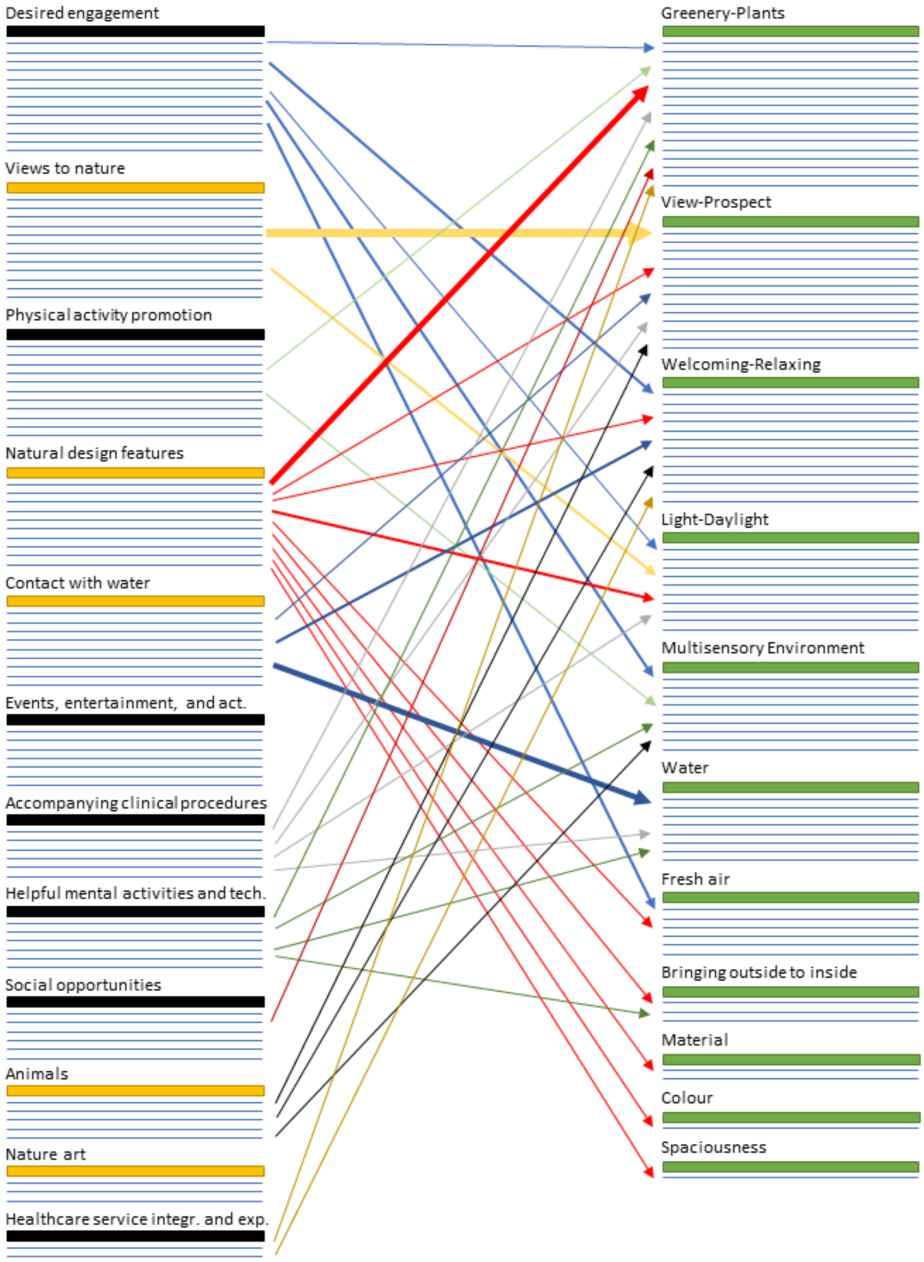


Figure 4-2: Interrelation between the recommendations' titles and biophilic design parameters.

As shown in Table 4-9, while participants referred to the most recommended function 'Desired engagement', explicit expressions indicated some of the biophilic design parameters to create this engagement. Four references were related to Multi-Sensory Environment, four references were related to Fresh Air, four references were related to Welcoming-Relaxing Environment, three references were related to Greenery and Plants, and one reference to Daylight. Four out of 12 informants recommended views to nature in connection with the contact with Daylight, primarily, while nine responses referred directly to View and Prospect.

Table 4-9: References to biophilic design parameters.

	Air	Bringing Oustide To Inside	Colour	Greenery	Light	Material	Multi-sensory	Spaciousness	View-Prospect	Water	Welcoming-Relaxing	**Total**
Animals	0	0	0	0	0	0	1	0	1	0	1	**3**
Contact with water specifically	0	0	0	0	0	0	0	0	1	6	4	**11**
Natural design features	2	2	1	6	4	2	0	1	1	0	3	**22**
Nature art	0	0	0	0	0	0	0	0	0	0	0	**0**
Views to nature	0	0	0	0	4	0	0	0	9	0	0	**13**
Accompanying clinical procedures	0	0	0	3	1	0	0	0	2	1	0	**7**
Desired engagement (sensory and private)	4	0	0	3	1	0	4	0	0	0	4	**16**
Events, entertainment, and activities	0	0	0	0	0	0	0	0	0	0	0	**0**
Healthcare service integration and expansion	0	0	0	1	0	0	0	0	0	0	1	**2**
Helpful mental activities and techniques	0	1	0	1	0	0	3	0	0	1	0	**6**
Physical activity promotion	0	0	0	2	0	0	1	0	0	0	0	**3**
Social opportunities	0	0	0	1	0	0	0	0	0	0	0	**1**
Total	**6**	**3**	**1**	**17**	**10**	**2**	**9**	**1**	**14**	**8**	**13**	

Although the ‘physical activity promotion’ recommendation was the third most commonly advised in the paper, only three references to biophilic design parameters were identified in this category: two references to Greenery, and one to the Multi-Sensory Environment.

On the other hand, the “natural design features” was recommended by only half of the participants, but they provided 22 references connected to biophilic design parameters: Greenery and Plants led with six references, followed by four references to Daylight, three references to Welcoming-Relaxing Environment, two references to Fresh Air, Bringing Outside to Inside and Materials, and one reference to Colour, Spaciousness and View-Prospect. One of the natural design features was Water, analysed under a different title: “contact with water specifically”. Therefore, in the given responses, 11 references were identified in connection with biophilic design parameters, six of which explicitly referred to Water elements, such as rivers, lakes and running water; four references related to Welcoming-Relaxing feelings, and one reference was connected to perceiving Spaciousness.

Socialising opportunities was one of the most commonly sought functions of therapeutic designs for cancer patients, as observed in this study. Despite the fact that Socialising is not a biophilic design parameter, biophilic interventions are able to promote socialising characteristics of the space. There were nine references about Socialising, extracted from the recommendations, but they were not included in the analysis shown in Table 4-9 and Figure 4-2, since they employed only explicit biophilic design elements. Moreover, the study had several recommendations in relation to fittings and furniture design to enhance a visual connection with the outside.

The results indicated that the main objectives of all recommendations were to create a distraction from unpleasant thoughts and conditions caused by cancer itself and the clinical environment, and to relax and calm the people while fighting death. In order to reach these objectives, this study revealed important environmental expectations of cancer patients. These features were mainly related to the biophilic design parameters although the authors did not specifically define them as "biophilic".

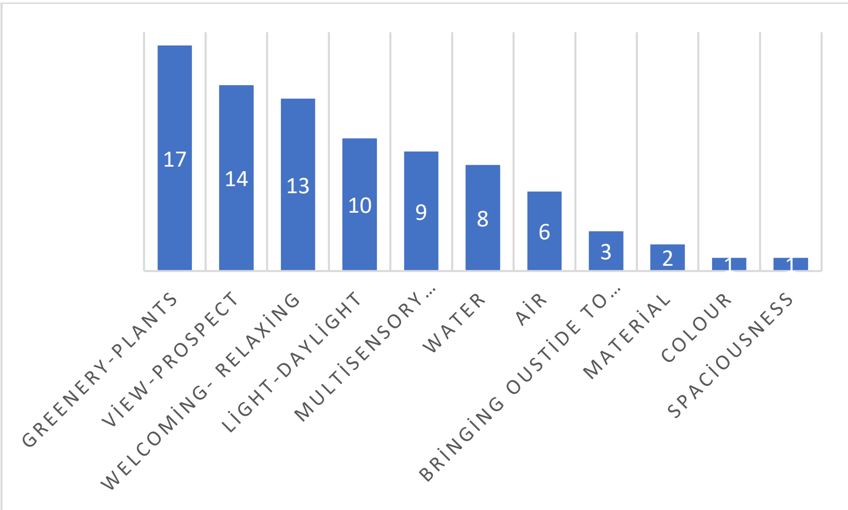


Figure 4-3 References to the biophilic design parameters in the recommendations.

In summary, the analysis showed that the resulting recommendations included 84 references to 11 different biophilic design parameters. Greenery was the most frequently mentioned parameter out of all biophilic design parameters, with a total of 17 references, followed by View-Prospect with 14 references, Welcoming-Relaxing Environment with 13 references, and Daylight with 10 references. Also, Multi-Sensory Environment, Water, Fresh Air and Bringing Outside to Inside were other outstanding parameters (Figure 4-3). It should be noted that this research concluded with recommendations for cancer patients in clinical settings specialised in the oncological treatment, thus the recommendations were principally focused on promoting the environmental quality of hospital rooms in which cancer patients usually cannot have active movement ability due to their health conditions. Therefore, their aspirations and recommendations for a better clinical environment were concentrated on two main outcomes. Firstly, they sought an opportunity for relaxing and calming, exacerbated by their lack of physical activity condition. Secondly, they usually directed their recommendations toward finding a distraction from unpleasant thoughts and better-preventing stress and anxiety.

The second part of the research conveyed cautionary advice from participants in which they identified eight aspects of natural engagement that might cause adverse experiences. The study classified these aspects: Appropriateness, Safety, Allergies, Healthcare investment, Negative trigger, Overwhelm, Sensory overstimulation, and Not valued/Not interested.

Appropriateness and Safety were considered important cautions by a significant portion of participants (Table 4-8). Seven participants mentioned Appropriateness, and their concerns primarily focused on financial spending and suitable design materials. Although the cautions related to Safety and Allergies mainly concerned allergic reactions, toxic plant material, and contact with bacteria, the study stated that some participants explicitly expressed "nature engagement in the clinal environment being no greater risk than their everyday contact with nature outside". The cautionary advice, however, presented a dilemma since the concerned samples were mainly individual cases with specific issues like allergic reactions. Artificial nature was advised to grant safety and prevent allergy-related issues by some interviewees, but some others found fake natural elements inappropriate.

To sum up, interviews with patients in this study also revealed their expectations and recommendations about how nature connection can be applied in practice:

- In order to relieve the stark atmosphere, the design can introduce natural materials such as natural timber and natural wall colours, fish tanks, and natural objects. However, the designers should avoid design elements that are undesirable or demanding, as they may trigger intense dislike, overstimulation or overwhelm. Also, safety should be considered cautiously by investigating and preventing the inclusion of allergy-inducing, slippery or otherwise challenging surfaces.
- Indoor planting can be incorporated with potted plants and green walls when appropriate and with caution. However, safety is of paramount concern when engaging with nature in a clinical setting, consideration must be given to factors such as allergy-inducing and toxic plants, soil bacteria for patients at high risk of

infection, and sensory overstimulation. Considering the restrictions of clinical environments, high-quality artificial plants can be installed at a low cost and with minimal maintenance requirements in areas where live plants are not permitted or unsafe.

- Indoor seats and inpatient beds that are strategically located to maximise the use of natural window views can motivate patients and staff to take advantage of these opportunities.
- Patients suggested collaborating with volunteer services to provide opportunities for assisted walks outside the hospital building and visits to hospital gardens and courtyards, as well as contact with therapy animals.
- During clinical procedures, digital devices with interactive nature displays and sounds, such as virtual reality headsets, can be used to distract patients from unpleasant thoughts and reduce anxiety. Furthermore, patients reported using technology to listen to nature sounds to help them sleep better. The ability to appropriately scale visual, sound, and tactile intensities is one advantage of such technology-based nature experiences.

4.5.2. Study 2: The experiences of cancer patients within the material hospital environment: Three ways that materiality is affective

'The experiences of cancer patients within the material hospital environment: Three ways that materiality is affective' was published in Social Science & Medicine Journal in 2020 by Gareth Wiltshire, Emma Pullen, Frankie F. Brown, Mike Osborn, Sarah Wexler, Mark Beresford, Mark Tooley and James E. Turner.

This research's main goal was to explore the role of the material hospital environment for cancer patients in order to improve the patients' experience. The study reported focus group interviews with 18 cancer patient participants from one medium-sized acute hospital trust in the UK, where patients receive treatment within existing and new clinical facilities. No more information about the environment was provided.

The focus groups employed two questions to start a dynamic conversation around the topic: *Which features of the hospital building are good/not so good for wellbeing?* and *What kinds of visual and sensory features bring on feelings of pleasure or discomfort in the building?*

According to the study, numerous patients reported the importance and efficacy of Welcoming-Relaxing (calming and restful) feelings that originated from being in connection with natural elements within the healthcare environment. The presence of Plants and Water, Visual Natural Scenes and Views, Sensory richness and Quietness were associated with relaxing feelings. The study analysed some responses from the patients about existing natural features as follows (p.4):

> *One participant enjoyed the sight of the floral arrangement at the reception desk as she entered the hospital foyer, and a fish tank that was previously kept at the reception was well-received "because it's very relaxing." Both of these ephemeral feeling states rely on the visual field of the patients as they unconsciously recognise and begin to co-produce the 'pre-emotional' affective qualities that direct lived experience. Interestingly, the pleasant intra-actions with nature were also experienced when those elements were artificial depictions. Indeed, one patient claimed, "I quite like visual scenes of environment – mountains and streams that sort of thing. That is pretty commonplace [in this hospital] and it's quite restful.*

The absence of pleasant visual contact was indicated in the responses. The windows were criticised in this regard because they were too high to benefit from a direct line of sight to the outside area, a patient claimed: *"*you can't even see a tree moving or anything*".* While another participant expressed the general yearning of cancer patients for pleasant sights (p.4): "You just think 'if only that were a nice garden space that you could wheel your drip out to and get a glimpse of cloud'."

Visual connection with a natural environment was also associated with bringing focus for distraction from unpleasant thoughts, as the patients experienced the importance of distraction provided by some artworks such as photograph exhibition in the setting (p.4): "There are ones [artworks] that you just see and you forget what you're here for."

Another crucial point was Daylight and Spaciousness since several participants described the hospital's atmosphere as dark and depressing due to the low ceilings. Furthermore, the doors of the oncology were perceived as psychologically overwhelming by a breast cancer patient who "felt sick to her stomach because of the sight of the doors". The study recommended the Maggie's Centres' doors from Martin et al.'s (2019) study in which the symbolic quality of the material features and warm greeting of the doors were reported.

Access to the natural environment from waiting rooms where the users usually feel stressed was another critical concern. The participants complained that they felt stuck in waiting rooms because of the fear of missing their names announced, therefore they were unable to go to the courtyard to have access to Fresh Air, Daylight and Views in order to calm themselves down.

The participants criticised the Sensory Environment of the hospital environment. Noises of medical equipment, 'buzzing' of alarms, 'bleep' of the drips, and overall noisiness irritated the participants with a general agreement. The poor auditory experience caused by the machines was explained by a high-grade lymphoma patient (p.4):

> *I'd forgotten just how much that got to upset me by the end of it … By the end of it, I found the whole place really irritating and upsetting. I didn't really realise how much it was affecting me until on the odd occasion my wife came and met me and I was on edge. And the noise was one of the big things, especially when they're busy and it's endless. Bingbong, bing-bong, bing-bong, bing-bong.*

Patients were more sensitive to the smell of the hospital since they commonly faced anxiety and nausea experiences. A patient claimed: "The last thing you want to be doing when you come in through this – especially when you're feeling nauseous – is to go into a place that smells."

In terms of Thermal Comfort, overall it was agreed that the environment was uncomfortable and too hot (p.4)*: "*Everything was far too hot in the hospital". Along with the heating system, the material choice was shown as another reason for the feeling of an over-heated space. The plastic material used in furniture irritated some of the interviewees, exemplified in the plastic seats, which were described as uncomfortable since they made the users sweat. One patient said (p.4): "The seats make you very hot. That was one thing that we did [give feedback about] because they're plastic."

The physical characteristics of the environment in the doctor's room where they got to learn their diagnosis, was also prominent in the responses, as this moment was a turning point in their life. Spaciousness, Comfort and Calmness were sought by considering Material choice, furniture and other objects in the diagnosis rooms. A participant shared her experience of receiving the diagnosis (p.6):

> *The room is absolutely tiny. There's not really anywhere to sit. And you have to actually sit on the bed. I sat on the bed, yeah. If you've got a visitor. Your visitor sits on the chair and then the doctor stands and talks to you. The image you get of being told you've got cancer is, you know, sitting in front of the desk, you know, the doctor sitting in a chair. He's got reference books, you know. Whereas, you sort of*

feel like you're sat in this little poky room because you're not important enough. And you just feel that you … it's just really awkward to be told you've got cancer sitting on a bed, tiny little room with two doctors standing there – because mine was two doctors standing – talking to you. So, for them to now tell me I am terminal, standing there in this tiny little room, no window at all … I wasn't sitting comfortably, as I was sitting on the bed. They need to make you feel that they are talking to you and you alone, they're not standing waiting to go out the door to talk to someone else.

Another focus of the study was the impact of Socialising on the environment. Interacting with other cancer patients can have psychological drawbacks along with benefits. In some cases, it was claimed that meeting or just observing other cancer patients evoked a feeling of worry and anxiety by thinking "is that my future? I don't want to be like that" or "are they further down the line than me?". However, in many cases, social interaction was welcomed because talking with other cancer patients increased their awareness of the illness and helped them to understand whether their symptoms are normal. Another concern was the spatial layout, the cancer patients felt segregated. The space arrangement was such that it exposed cancer patients while going to the chemotherapy room, which only cancer patients were allowed to access. This caused a feeling of being "tucked away" from those who do not have cancer. Also, the journey between the waiting room and the therapy or diagnosis room was perceived as a "walk of shame" because of noticing, gazing, wondering, and judging the sights of other people (p.5):

And we don't want to feel like we're tucked away. Whereas here we feel like we're tucked away because we go up this little ramp and you're like, you're away from everybody else because you've got cancer! And you're infectious! We're the ones that nobody wants to talk to! [laughter] You know, it does feel a bit like that doesn't it. Because you're in there and then there's this other door. That's where people go when they've got no hair.

Moreover, lack of privacy was another crucial issue for cancer patients, particularly after diagnosis (p.5):

I remember going out and crying in the waiting room with my daughter. I was just hugging her. She was crying. She was crying and I was crying. And it was in front of everybody. We had nowhere to go that was a private space.

Therefore, the statements in this study proved that cancer patients need an environment that allows them to socialise with others without being isolated as long as they have an opportunity to withdraw for privacy. Prostate cancer patients also preferred privacy in toilets, instead of waiting to use toilets consistently in the corridors since their treatments involve drinking more fluid than other cancer treatments.

Overall, the participants sought biophilic design elements within oncology settings. Contact with nature was welcomed even if it was artificial, as a patient claimed (p.4):

> *There's this artificial window that's got blue sky and a tree with blossom on, and suddenly it was just really lovely to see that, although it's completely artificial. And also the little room you have to wait in for an hour while things are draining through you, they've got beautiful paintings on the wall and wildlife and lavender and things. And I remember that and just thinking 'wow, this is almost like being outside again'.*

This study proved that Welcoming-Relaxing feelings originated in cancer patients from contact with natural elements, where Fresh Air, Daylight, Spaciousness, Plants, Water, Views, Multi-Sensory environment, were especially important. Also, the need for Privacy was highly underlined, while Socialising opportunities were welcomed as long as they could have a chance for withdrawal and get privacy.

In summary, the study supported the following guidance:

- The entrance of the facility is an important space as arriving people often face high levels of stress and anxiety. Creating a welcoming atmosphere with biophilic touches such as a floral arrangement at the reception desk, or a fish tank in the foyer can relax people.
- In spaces where contact with real natural elements cannot be created, the environment can be supported by artificial scenes, plants, electronic windows, or nature-related artworks. Even if the artificial elements are not able to enrich a sensory environment, they can bring a visual focus for a distraction though.
- High ceilings can be recommended to create a spacious and light environment, along with light accessible fittings which do not overwhelm patients. The doors were particularly indicated in the study, welcoming sliding doors with warm natural material can be the best option based on the examples (Maggie's Centres) given in the study.

- The waiting rooms should have easy and rapid access to the outdoor environment where the patients are able to hear when their name is announced or see a board showing the list of announced people. Also, the indoor environment should provide sufficient fresh air, daylight and view to reduce the need for leaving the room.
- The auditory and olfactory quality of the facilities should be improved, the noises of medical equipment should be minimised as well as the heavy smell of medicine and plastic.
- Material choice and heating system should be considered in terms of thermal comfort of the patients, as the study reported that the environment was overall too hot. Plastic materials also should not be preferred in furniture to increase thermal comfort.
- Spaciousness and calmness were sought in diagnosis rooms. Furniture and materials should be comfortable and relaxing.
- Socialising opportunities can be created by spatial arrangement; however, socialising should not be enforced by the environment on everyone but should be easy for people who need to interact with others.
- Privacy should be one of the most critical concerns in the design, some private enclosures or spaces should be provided to those who want to cry or disappear from the sight of unfamiliar people. The spatial arrangement between waiting rooms and chemotherapy rooms should consider privacy either to prevent long walks when the patients are exposed to others' gazes. Also, privacy in front of the toilets or in waiting queues should be designed well.

4.5.3. Study 3: Nature-based care opportunities and barriers in oncology contexts: a modified international e-Delphi survey

'Nature-based care opportunities and barriers in oncology contexts: a modified international e-Delphi survey' was published in BMJ (British Medical Journal) Open in 2017 by Sarah Blaschke, Clare C O'Callaghan and Penelope Schofield.

The main objective of this publication was to explore healthcare and design experts' recommendations for nature engagement in cancer settings and to gain insight into nature-based design in the oncology context. The study used a four-round electronic Delphi study. A Delphi study produces new questions based on responses from the previous round of questions (Schmidt & Kong, 1997). In this study, 200 potential participant experts, identified from healthcare practitioners, managers, designers, architects and researchers, were invited to complete a questionnaire (Questionnaire 1) where the experts were asked to consider recommendations from the patients as well as their own recommendation for nature-based care opportunities. Consequently, 38 experts across seven countries replied to the first round of questionnaires, and the response rate for the next three rounds was approximately 83%. Questionnaire 2 validated categorised items from the responses of Questionnaire 1. Questionnaire 3 contributed to prioritising identified items, while Questionnaire 4 aimed to rank the items. The opportunities and barriers for nature-based cancer setting design were extracted from these responses and ranked, based on the level of importance attributed by the participants.

The study revealed the ten highest-ranked opportunities and barriers. Table 4-10 explains these opportunities. The highest-ranked item was *'Window views from clinical areas onto nature, garden, sea, sky, weather, people watching, greenery, trees, outside world, daylight, night sky, escape, movement, change, without glare, attention to privacy (one-way views)'.* This item plainly indicates the importance of visual connection with natural elements in a hospital room. Although it mainly focused on the View parameter of biophilic design, some references to other biophilic design parameters contributed to this statement: Greenery, Water, Seasonal Changes, Outside-Inside Effect, Daylight, Prospect and Refuge. However, this item only referred to the visual perception of these biophilic elements, except for Prospect and Daylight, which principally are contained within visual senses.

The second item prioritised was accessibility to outdoor settings, gardens and courtyards; and the third item represented outdoor physical activity opportunities. Although there was no direct reference to biophilic design parameters, the term 'garden' can be associated with Greenery and Plants and their Multi-Sensory Environment, Fresh Air, and Daylight.

No association with biophilic design parameters was detected in items 5 and 7. Whereas the sixth item 'Design for privacy' represented the biophilic design parameters of Refuge, feeling Safe, and feeling Relaxed. Safety (item 8), and Socialising (item 9), were emphasised as essential features of a healing environment. Even though Safety and Socialising are not classified as biophilic design parameters, they should be taken into account during the implementation of biophilic design interventions in healing environments, since the wrong application of some biophilic elements in the design process might be counterproductive if they were not considered well.

Lastly, the tenth item *'Indoor design to maximise use of biophilic elements: natural materials, natural colours, airflow (including windows that open safely) and natural light'* directly referred to the biophilic design parameters: Natural Material, Natural Colour, Fresh Air, and Daylight.

Table 4-10: Highest-ranked opportunity items as expressed by experts, and identified direct references to biophilic design parameters (Ranking and Item descriptions were quoted from Blaschke et al., (2017)).

Ranking Items	Item description	Detected references to biophilic design parameters
1	Window views from clinical areas onto nature, garden, sea, sky, weather, people watching, greenery, trees, outside world, daylight, night sky, escape, movement, change, without glare, attention to privacy (one-way views)	View, Prospect, Daylight, Greenery, Seasonal Changes, Outside-Inside Effect, Water, Refuge
2	Accessible outdoor settings, gardens and courtyards: easy and effortless access, automatic doors, nearby, some areas with high visibility, close proximity to clinical assistance, remove barriers and thresholds, available for patients, carers and staff	Greenery, Multi-sensory Environment, Fresh Air, Daylight
3	Physical exercise adapted to patient requirements: stroll garden, walking paths with points of interest and distance markers (plant species, medicinal plants), meandering trails, resting points, exercise opportunity for staff, nature walks, mindful walking, mobility and balance training, gardening tasks, assisted walking, nature exercise rooms, labyrinths	Greenery, Multi-sensory Environment, Fresh Air, Daylight
4	Appropriate safety measures and surface materials for limited mobility: handrails, smooth paved paths, ramps rather than steps, colour contrasting curbing along pathways	Natural Material
5	Educate healthcare team, management, patients, designers, policy and decision-makers about value, benefits and appropriate implementation of nature-based opportunities	
6	Design for privacy: zoning, screening, semi-enclosed spaces, restful, contemplative and solitary spaces, some outdoor spaces shielded from inside views, separate but nearby spaces for staff to retreat (away from patients and workplace)	Refuge, Feeling Safe, Feeling Relaxed
7	Design proposal needs to address repair and maintenance requirements of nature-based features within available maintenance budgets (easy to maintain). Tasks to be carried out by skilled professionals	
8	Protection from adverse weather conditions (sun, shade, high/low temperatures) and unpleasant stimulation (overpowering scents, noise, loud sounds, toxic plants, clutter)	
9	Socialising: range of seating options, gathering and communal spaces, BBQ area, children play areas, semiprivate enclosures for personal conversations	
10	Indoor design to maximise use of biophilic elements: natural materials, natural colours, airflow (including windows that open safely) and natural light	Natural Material, Natural Colour, Fresh Air, Daylight

The analysis of these design opportunities helped to identify a hierarchical order for those biophilic design parameters mentioned by the informant experts in the e-Delphi study. The ranking of groups was created by taking into account how clearly and comprehensively the parameters were expressed in the item descriptions. The importance levels of the examined biophilic design parameters are explained in Table 4-11, group by group.

The first group includes the most critical parameters of biophilic design in an oncology setting. View, Prospect, Refuge, and Daylight were clearly stated in Item 1 above. The statements in the description comprehensively defined the environmental characteristics relevant to these parameters as View, Prospect and Refuge, and Daylight can be employed through windows. However, Greenery, Seasonal Changes, Outside-Inside effect, and Water were not included in the first group because they were only considered in relation to their visual impact, regardless of the other sensual stimulations they provide. Therefore, it made more sense for these parameters to be in a separate group, and were allocated to the fifth group.

The second group consisted of parameters extracted from items 2 and 3: Greenery, Multi-Sensory Environment, Fresh Air. Greenery was also implied in item 1, but only visually. The third group contained the parameters Feeling Safe and Feeling Relaxed. Although item 6 was also clearly related to Refuge, it was categorised in the first group, as it had a stronger correlation. Natural Material and Natural Colour were expressed in item 10 clearly and comprehensively and were allocated to the fourth group.

Table 4-11: Ranking of biophilic design parameter groups based on analysis of the opportunities.

Importance Level	Biophilic Parameters
1st Group	View, Prospect, Refuge, Daylight.
2nd Group	Greenery, Multi-sensory Environment, Fresh Air
3rd Group	Feeling Safe, Feeling Relaxed
4th Group	Natural Material, Natural Colour
5th Group	**(Only Visual Perception Described)** Seasonal Changes, Outside-Inside Effect, Water

The highest-ranked barriers, collected in Table 4-12, described the most common problems encountered to achieve a relationship with nature in oncology settings. The items ‘Building design and site constraints’, ‘Inaccessibility’, ‘Inappropriate design choices and execution’ and ‘Inauthenticity of nature-based design elements’ were directly related to design decisions and design process, and can be accomplished if the designers prioritise a biophilic design approach. The ninth item is closely related to the barrier stated, which expresses the lack of biophilic thinking in the examined projects: ‘Not prioritised in construction and development phase of healthcare projects’. However, as stated in the sixth item, the design guidelines for healthcare facilities are often primarily focused on the efficient provision of medical treatment to patients.

Table 4-12: Highest-ranked barrier items by experts (Blaschke et al., 2017).

Ranking	Item description
1	Building design and site constraints, missed opportunities: layout, building orientation, surrounding views, lack of available space was not considered in planning and development phase
2	Decision makers, management and administration often lack knowledge and/or awareness about benefits of nature engagement
3	Inaccessibility: heavy, locked doors, no electronic door opener, barriers, thresholds, doorways and pathways too narrow for wheelchair or gurney access or for two wheelchairs to pass, too wide paver joints become tripping hazards, insufficient seating, co-opted as smoking areas, access for the very sick and frail not considered
4	Cost and resource allocation: cost for routine repair and maintenance, staff and volunteer time, acquiring indoor equipment (screens, virtual reality, A/V), lack of funding, often based on fundraising and grants
5	Inappropriate design choices and execution: limited greenery, cold and stark, too much hardscape (concrete, glare), uncomfortable seating, too demanding, complex, static or boring environments, insufficient shading, materials too hot to the touch, structures/sculptures that cast odd shadows
6	Healthcare facilities design often guided by clinical functionality, efficiency, cost restrictions and/or habitual practice, not necessarily the patient perspective/experience
7	Mainstream values (decision makers) do not prioritise nature-based opportunities or 'design thinking'
8	Champion (advocate) needed
9	Not prioritised in construction and development phase of healthcare projects
10	Inauthenticity of nature-based design elements: fake plants, fake scents, tokenistic, corporate design ('cutting edge' award-seeking designs)

In summary, the study guided some design implementation based on the opportunities and barriers surveyed with the experts:

- First and foremost, the most important barriers to creating a biophilic healing environment are caused in the decision-making process before designing the healthcare settings. Decision-makers do not prioritise nature-based opportunities or 'design thinking'. Clinical functionality, efficiency, cost restrictions or habitual practice are often the main concern of healthcare facilities' design regardless of the patient perspective/experience. In order to sort these barriers, decision-makers, designers, management, and administration should have knowledge about the importance of nature engagement and biophilic design, therefore, the site decision, layout, building orientation, surrounding views, etc. can be considered in the planning stage. Skilled professionals can regulate the design proposal that addresses repair and maintenance requirements of nature-based features within available maintenance budgets. Furthermore, the lack of knowledge and ability of the designers also leads to inappropriate design choices and executions, such as cold and stark spaces, too much hardscape like concrete, glaring materials, or materials too hot to the touch, uncomfortable furniture, too demanding, complex, static or boring environments, insufficient shading or lighting, structures that cast odd shadows that might lead to anxiety, etc.

- Indoor design should maximise the use of biophilic elements: natural materials, natural colours, airflow and natural light. However, this maximisation should be within the frame of safety and security considerations. The users should be protected from overstimulation such as overpowering scents, noise, loud sounds, toxic plants, clutter; or adverse weather conditions and high-low temperatures like overexposure to the sun, or shade. The inauthenticity of nature-based design elements was claimed as a barrier to nature engagement such as fake plants, fake scents, and tokenistic. However, plants are strictly prohibited in some clinics due to infection risk, thus, fake plants or scents are welcomed to create nature engagement on some level.
- Window views from clinical areas onto natural elements and the outside world are critical to creating a healing environment, appropriate natural light exposure should be provided without glare. Windows design should also give attention to privacy by providing one-way views. Positioning patient beds regarding the view and daylight exposure can also help to improve perceived environmental features. Another important factor is windows should provide airflow naturally in the scope of safety arrangements.
- Outdoor settings should have easy and effortless access to patients and staff, all barriers and thresholds should be removed for patients, and automatic doors can improve easy access. Greenery and comfortable amenities where users can chill and relax should be sufficient. Shade and sunny areas should be balance in order to provide space for individual comfort. Outdoor settings should offer physical exercise opportunities for both staff and patients, particularly adapted to patients' conditions, such as stroll gardens, walking paths with points of interest and distance markers (plant species, medicinal plants), meandering trails, resting points; in terms of staff exercise opportunities, nature walks, mindful walking, mobility and balance training, gardening tasks, assisted walking, labyrinths, etc. were recommended.
- Accessibility and safety should be considered in all details. For example, non-slip surface materials, smooth paved paths, ramps rather than steps, and colour contrasting curbing along pathways can be implemented in the design. Also, heavy

doors, barriers thresholds, narrow doorways and pathways for wheelchairs are some expels of barriers that should be avoided.

- The efficient healthcare design should provide privacy as well as socialising opportunities. Privacy can be included in the design by zoning or screening spaces or providing solitary spaces for rest or contemplation. Outdoor spaces shielded from inside views can increase nature engagement, particularly staff need separate places for a retreat away from patients but with easy access back to patients. On the other hand, socialising opportunities can be included in the design by arranging seating and gathering options, the inclusion of communal spaces, children's play areas, semiprivate enclosures for personal conversations, and even BBQ areas.

4.5.4. Study 4: Inadequacy and impact of facility design for adolescents and young adults with cancer

'Inadequacy and impact of facility design for adolescents and young adults with cancer' was published in the Journal of Environmental Psychology in 2020 by Kati Peditto, Mardelle Shepley, Naomi Sachs, Jane Mendle, and Anthony Burrow.

The study aimed to measure the differences between the current provision of healthcare environments and the actual needs of adolescent and young adult cancer patients. This quantitative research obtained data via a questionnaire with cancer patients aged 15 to 39 years. The participants were recruited through various cancer organisations' social media channels and private groups. Having eliminated the ineligible informants and spam, it was found that a total of 104 people completed the questionnaire. The questionnaire asked participants to rate the importance of environmental qualities in treatment settings and to rate the importance of environmental characteristics. The results revealed that patients reported a noteworthy discrepancy between importance and effectiveness for 22 environmental characteristics.

According to the results, all characteristics indicated in Table 4-13 were markedly inadequate, however, "outdoor space," "patient-only lounge," "visitor beds in patient rooms," "meditative space," "temperature control," and "personalisable rooms" were found the most inadequate.

Table 4-13 ranked 22 characteristics in reference to the importance of effectiveness based on the questionnaire results. The first and second most important characteristics stood for privacy. Even though privacy is not a biophilic design parameter, it is deeply connected with refuge, security and protection parameters as well as it supports welcoming features. Likewise, the 'daylight', 'temperature control' and 'outdoor space' were the characteristics directly or indirectly associated with biophilic design parameters and ranked in the top six most important characteristics.

Table 4-13: Adequacy of the built environment (Peditto et al., 2020).

	Mean Importance Effectiveness
Private bathrooms	4.76 (0.65)
Private bedrooms	4.70 (0.65)
Daylight	4.68 (0.64)
Internet and computer resources	4.67 (0.63)
Temperature control	4.61 (0.69)
Outdoor space	4.42 (0.75)
Visitor beds in patient rooms	4.26 (0.84)
Therapy area (PT, OT, art, music)	4.23 (0.84)
Recreation (TV, games)	3.91 (1.04)
Small number of patients per unit	3.88 (0.95)
Staff-patient consulting area	3.79 (0.97)
Family-patient lounge	3.76 (0.97)
Moveable seating	3.63 (1.01)
Meditative space	3.62 (1.01)
Personal desk space	3.60 (1.13)
Personal closet space	3.53 (1.14)
Artwork	3.53 (1.08)
Access to kitchen	3.39 (0.99)
Personalizable rooms	3.32 (1.02)
Motivational message board	3.18 (0.94)
Patient-only lounge	2.98 (1.06)
Classroom	2.74 (0.95)

Although they did not refer to biophilic design parameters in an obvious way, the environmental characteristics 'Visitor beds in patient rooms', 'Family-patient lounge, 'Personal desk space', 'Personal closet space', 'Access to kitchen', 'Personalisable rooms', and 'Patient-only lounge' hinted to the parameters sense of belonging, feeling comfortable and welcoming indirectly. However, the informants considered these characteristics less important than the ones stated above.

Once again, having examined the interrelationship found between the environmental characteristics described in the study and several biophilic design parameters, it was possible to establish a ranking order and determine those biophilic design parameters that proved to be crucial in oncology settings for adolescents and young adults. Table 4-14 summarised the environmental characteristics by order of importance as well as the related biophilic design parameters. It can be seen that the parameters Refuge, Feeling Comfortable, Feeling Relaxed, Security and Protection were ranked at the top, however, it should be taken into account that the participants' responses referred to them indirectly. The following most important was Daylight, which was literally identified as an environmental characteristic. The third group contained Thermal Comfort, Mastery and Control.

Table 4-14: The environmental characteristics that had direct or indirect references to the biophilic design parameters.

Ranking	Environmental Characteristics	Biophilic Parameters
1	Private bathrooms*	Refuge, Feeling Comfortable, Feeling Relaxed, Security and Protection
2	Private bedrooms*	
3	Daylight	Daylight
5	Temperature control	Thermal Comfort, Welcoming Mastery and Control
6	Outdoor space	Greenery, Multi-sensory Environment, Fresh Air, Daylight
7	Visitor beds in patient rooms*	Sense of Belonging
12	Family-patient lounge*	Feeling Comfortable and Welcoming
15	Personal desk space	
16	Personal closet space	
18	Access to kitchen*	
19	Personalizable rooms	
21	Patient-only lounge*	

ASTERISK (*) INDICATED THE ENVIRONMENTAL CHARACTERISTICS INDIRECTLY CONNECTED TO THE BIOPHILIC DESIGN PARAMETERS

The fourth group of comments contained references to Greenery, Multi-Sensory Environment, Fresh Air, and Daylight, as it is broadly accepted that 'outdoor space' is highly associated with these biophilic design parameters. Lastly, some less important environmental characteristics are referred to as the parameters of Sense of Belonging, Feeling Comfortable and Welcoming.

To sum up, the environmental characteristics indicated in the survey also showed how to apply biophilic design parameters in a clinical environment. Private bathrooms, private rooms, visitor beds in the room, family-patient or patient-only lounge, personal desk, closet spaces, and access to a kitchen were seen as important characteristics which can improve and contribute to Refuge, Welcoming-Relaxing feelings and a Sense of Belonging. View and Daylight can be involved in the space through windows. Physical access to the outdoor settings, where Greenery, Fresh Air, Multi-Sensory Environment and Daylight can be experienced, was also stated as important environmental characteristics.

4.5.5. Study 5: Perceived Importance of Wellness Features at a Cancer Center: Patient and Staff Perspectives

'Perceived Importance of Wellness Features at a Cancer Center: Patient and Staff Perspectives' *Research'* was published in Health Environments Research & Design Journal in 2018, by Michelle Tinner, Paul Crovella, and Paula F. Rosenbaum.

This study aimed to reveal the importance of the impact of wellness features on the quality of care in a cancer centre, from both patients' and staff's perspectives, who also expressed their preferences for specific features. A post-occupancy evaluation via surveying two user groups was carried out. In total 72 staff and 62 patients were required in the survey to evaluate 11 building wellness features in the studied cancer centre, where the participants experienced a well-designed environment with sufficient daylight exposure, four-season enjoyable trees and greenery in the rooftop garden, direct view to nature from chemotherapy delivery rooms and child oncology department, indoor plants, and the presence of murals and other art pieces throughout the centre. The anonymous centre has also other distinct characteristics such as lack of visible medical equipment in the lobby and waiting areas, thermal comfort, access to spaces for social interaction, access to quiet space for privacy, and ease of movement as well as having attempt to avoid anticipatory nausea provoked by stimuli similar to the surroundings during chemotherapy.

The results showed that 'Ease of movement' was the overall most important feature of the building for patients, followed by 'Thermal comfort', 'Natural light', 'Art and murals', and 'Views of nature,' respectively (Table *4-15*). 'Art and murals' were also considered biophilic design elements since it was stated that artists represented nature in these pieces of art. 'Not seeing medical equipment' evoked a non-clinical feeling at least in common spaces and waiting rooms, and it surpassed 'Plants inside the building' and 'Access to the roof garden', which enabled direct contact with greenery and fresh air. Curiously, the least important feature was 'Access to social spaces'.

It should be noted that there were inconsistencies in the results of this study, evidenced in how the same parameter receives different appreciation based on how the question is formatted. For instance, when patients were asked about which features increased their confidence in the quality of care, 'Views of nature' was ranked as the most important feature (Figure 4-4.), while it was ranked in fifth place in the previous question (Table 4-15)

, where they were asked to rank features according to outcome, which explicitly asking about healing process and relationship with staff, highly related to the quality of care. Likewise, 'Ease of movement' was ranked in fourth and first places respectively.

Table 4-15: Building features ranked by patients according to outcome (Tinner et al., 2018).

Building Features	Overall Rank	Improve(s) Interactions With Staff Rank	Improve(s) Healing Process Rank	Improve(s) Relaxation Rank	Improve(s) Positive Thinking Rank	Improve(s) Mood Rank
Ease of movement	1	1	2	2	n/a	2
Thermal comfort	2	3	3	1	1	1
Natural light	3	2	1	3	2	3
Art and murals	4	5	4	3	3	5
Views of nature	5	7	6	5	4	4
Access to private spaces	6	4	5	6	n/a	6
Not seeing medical equipment	7	6	8	9	n/a	8
Plants inside the building	8	9	7	7	5	7
Access to the roof garden	9	8	9	8	6	9
Access to social spaces	10	10	10	10	7	10

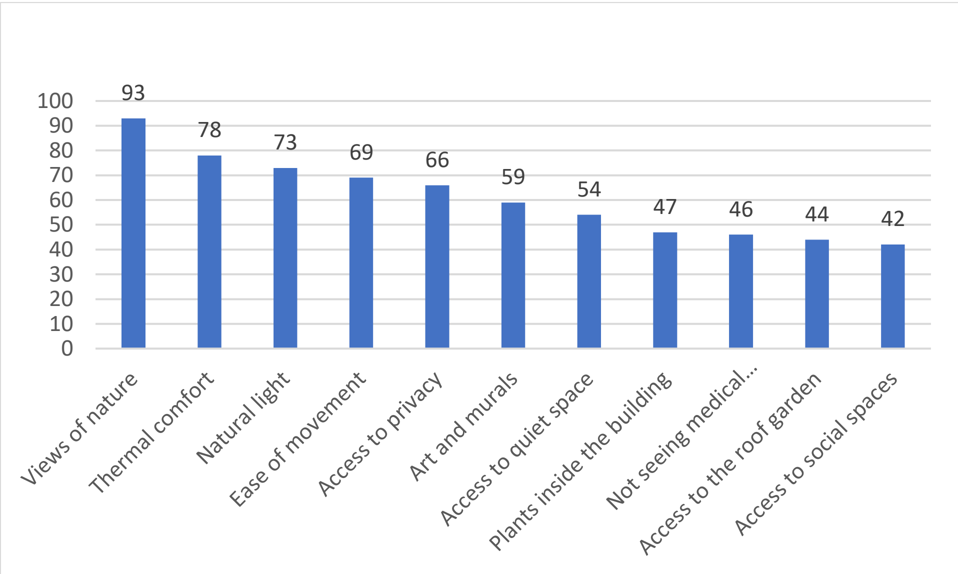


Figure 4-4: Features that increase patient confidence in quality of care—% (Tinner et al., 2018).

In another set of questions, patients were asked about patient infusion area treatment space preferences during chemotherapy treatment. As shown in Figure 4-5, 69% of the informants stated that they prefer getting treatment near the windows. The vast majority of them explained the reason for preferring being by windows was the presence of natural light and views of nature. Even though the spatial concept near the windows offered an opportunity for socialising, none of those who preferred being near the windows indicated *socialising opportunity* as a reason for their preference for the treatment location.

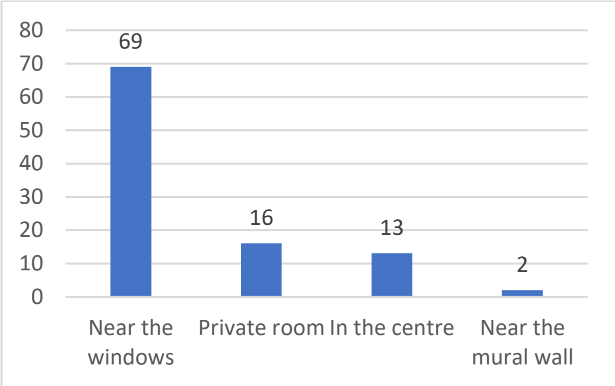


Figure 4-5: Patient infusion area treatment space preference—% (Tinner et al., 2018).

The research also investigated some juxtapositions based on statements provided by the centre's architects, such as the benefits and disadvantages of the open-plan design, as open-plan enabled the highest exposure to natural light but it also generated a noisier environment. In this regard, it was asked whether the patients preferred Quietness over Social Interaction and Privacy over Daylight and Views of Nature in the treatment area. It became evident that the majority of informants preferred Quiet treatment areas rather than Social Interaction, and Privacy to Daylight and Views of Nature (Figure 4-6).

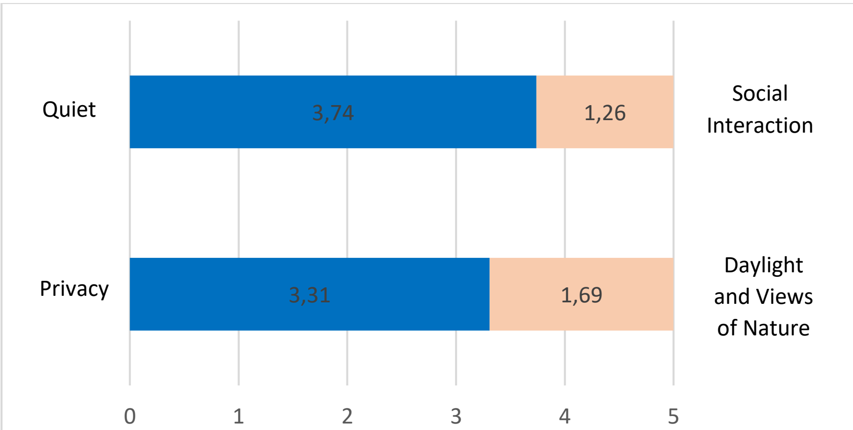


Figure 4-6: Patient treatment area preferences comparison (Tinner et al., 2018). (Based on rating following statements 1 (disagree) to 5 (agree), a) I prefer quiet over social interaction, b) I prefer privacy over daylight and views of nature.)

Furthermore, the patients were asked to evaluate four environmental features in the waiting area. Unlike preferences related to the chemotherapy area, where the patients favoured Privacy over Natural Light, the most preferred feature in the waiting area was natural light (Figure 4-7).

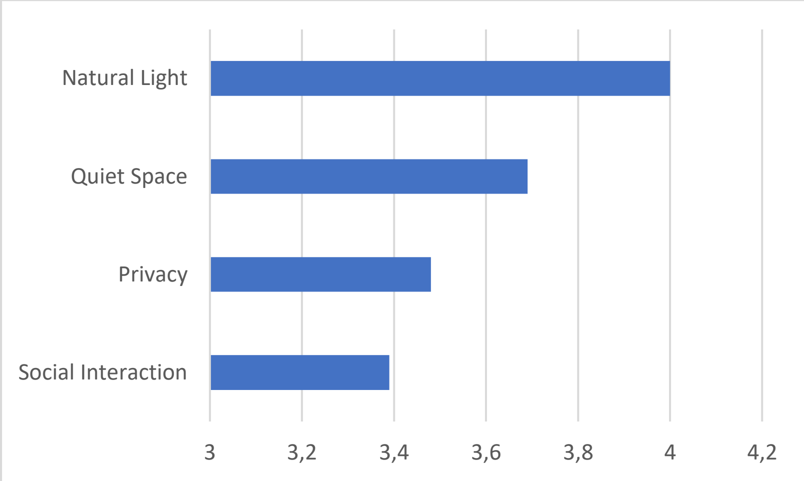


Figure 4-7: Patient waiting area preferences, based on ranking the importance 1 (disagree) to 5 (agree) (Tinner et al., 2018).

The results showed that the staff's preferences were different from the patients'. Namely, 'Access to private spaces' was the overall most important feature of the building for staff, followed by 'Access to quiet space', 'Thermal comfort' and 'Natural light', respectively (as shown in Table 4-16). 'View of nature' was ranked in seventh place, while other features relevant to biophilic design such as 'Plants inside the building', 'Art and murals' and 'Access to the roof garden' were decreasingly ranked as less important features for staff.

Table 4-16: Building Features Ranked by Staff According to Outcome (Tinner et al., 2018).

Building Features	Overall Rank	Improve(s) Interactions With Patients Rank	Improve(s) Interactions With Colleagues Rank	Improve(s) Ability to Provide Care Rank	Reduce(s) Stress Levels Rank	Improve(s) Focus on Work Rank	Improve(s) Mood Rank
Access to private spaces	1	1	2	2	1	3	5
Access to quiet spaces	2	3	3	1	2	1	4
Thermal comfort	3	5	4	3	4	2	3
Natural light	4	2	1	5	3	4	1
Ease of movement	5	4	6	4	5	5	8
Access to social spaces	6	8	5	6	7	6	7
Views of nature	7	7	7	8	6	8	2
Not seeing medical equipment	8	6	8	7	10	6	11
Access to the roof garden	9	10	9	9	8	10	6
Art and murals	10	9	9	10	9	9	9
Plants inside the building	11	11	11	11	10	11	10

Figure 4-8 illustrates the differences between staff and patients' opinions in terms of overall outcome mean for all building features. 'Plants inside the building' (Mean Difference (MD)=0.51), 'Art and murals' (MD=0.4), 'Access to social spaces' (MD=0.3), 'Views of nature' (MD=0.25) and 'Access to the roof garden' (MD=0.25) showed the greatest differences, while 'Thermal comfort' (MD=0.08), 'Access to private space' (MD=0.08), and 'Natural light' (MD=0.09) showed the smallest differences.

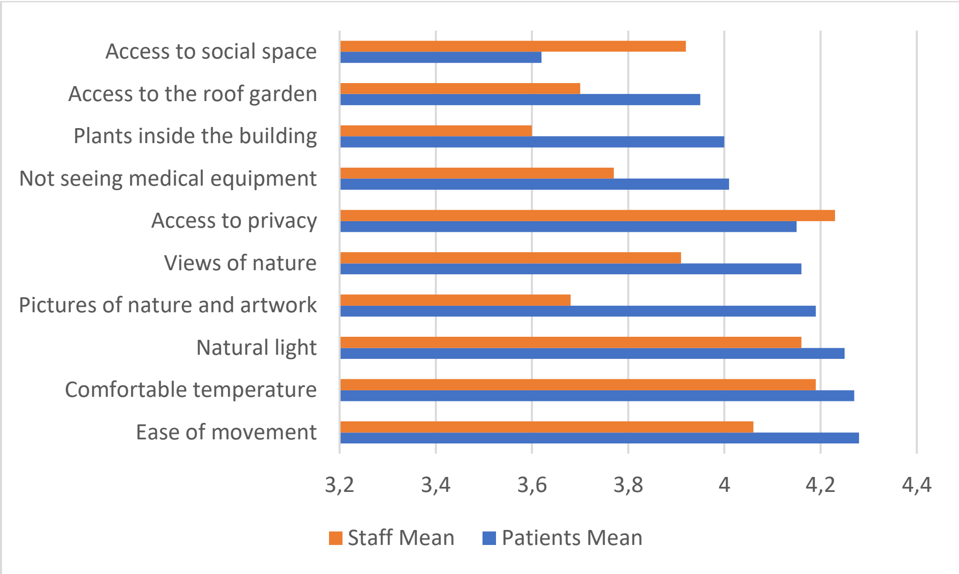


Figure 4-8: Patient and staff building feature ranking results arranged according to difference (Tinner et al., 2018).

Table 4-17: Patient and Staff Mean Building Feature Rankings. (Note. 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. Bold values are statistically significant (p < .05) (Tinner et al., 2018).

Feature	Patients Mean	Patient Ranking	Staff Mean	Staff Ranking	Significance (two-tailed)
Ease of movement	4.28	1	4.06	5	0.78
Comfortable temperature	4.27	2	4.19	3	0.637
Natural light	4.25	3	4.16	4	0.609
Pictures of nature and artwork	**4.19**	**4**	**3.68**	**10**	**<.001**
Views of nature	**4.16**	**5**	**3.91**	**7**	**0.039**
Access to privacy	4.15	6	4.23	1	0.554
Not seeing medical equipment	4.01	7	3.77	8	0.147
Plants inside the building	**4.00**	**8**	**3.60**	**11**	**0.007**
Access to the roof garden	3.95	9	3.70	9	0.067
Access to social space	3.62	10	3.92	6	0.075
Access to quiet space	n/a	n/a	4.21	2	n/a

Furthermore, independent t-test results, as seen in

Table *4-17*, indicated those features that statistically had significant differences. A t-test is a type of inferential statistic used to determine if there is a significant difference between the means of two groups, which may be related to certain features (T. K. Kim, 2015). Therefore, patient and staff opinions differed significantly in three features, 'Pictures of nature and artwork', 'Plants inside the building', and 'Views of nature'. All three of these features, which also represent biophilic features, were more valued by patients than by staff.

Overall, in terms of design features directly related to biophilia, Thermal Comfort and Daylight were considered the most important parameters for both groups of respondents, as there was no significant difference between patient and staff opinions. View followed Thermal Comfort and Daylight since it was ranked in the first place by patients as a trigger of confidence in the quality of care, and the overall ranking did not differ as much as 'Pictures of nature and artwork' did. Although Privacy was more strongly favoured by staff and ranked as the most important feature, the statistical differences were not significant in patients' opinions. Thus, Privacy was also one of the most important features of the cancer centre. The study did not include patients' overall opinions on 'Access to quiet space', but it was one of the most preferred features, as illustrated in Figure 4-4, Figure 4-6 and Figure 4-7, as well as being the second most valued feature by staff. Interestingly, plant and greenery relative features were ranked among the less important features by both patients and staff. However, the staff was considerably less interested in plants. The study suggested two main reasons for this: the chore of having to water them and the fact that they can bring pathogenic fungi that pose a threat of infection to patients, which was proved by several studies (Hedayati et al., 2004; Summerbell et al., 1989). Table 4-18 demonstrates a ranking of biophilic design parameters groups arrangement based on the result of the study.

Table 4-18: Ranking of biophilic design parameters for staff and patients.

Ranking	Patients	Staff
1st	Thermal Comfort Natural Light View-Prospect	Privacy-Refuge, Quietness
2nd	Privacy Quietness Pictures of Nature	Thermal Comfort, Natural Light
3rd	Plant-Greenery	View - Prospect
4th		Plant-Greenery

In summary, lessons learnt in terms of implementation into practice from the study:

- Creating a non-clinical feeling is an important design driver, medical equipment should be hidden from patients' eyes where it is possible, for example in common spaces and waiting rooms.

- Ease of movement is the most important feature of the building for patients, accessibility should be maximised, and all barriers should be removed. Also, rapid and easy access between outdoor settings, foyer-waiting rooms, and treatment settings should be rigorously considered.
- As the most commonly preferred location within the treatment (chemotherapy) room, seats nearby the windows should be maximised, and the spatial arrangement should be designed to deliver optimum daylight and provide uninterrupted views in a bigger portion of the room.
- Open-plan layout provides the highest exposure to daylight and socialising opportunities, but creates a noisier environment. According to this study, patients sought more quietness and privacy in the treatment area. Therefore, the inclusion of open-plan spaces needs more rigorous in order to create a balance. The ways of creating privacy and quietness should be examined and implemented in open-plan designs.
- Waiting areas should allow more daylight exposure, and generate a quiet environment to reduce patients' stress levels.
- The study claimed that providing optimum thermal comfort is a mixed-use scenario as it depends on the season, windows effect as well as personal reasons such as clothing or occupants' metabolic rate. Therefore, the designers were recommended to focus on personal adaptation by providing personal control devices like warmed blankets or heated seating during the cold season and small fans during the hot season.
- Easy access to private and quiet spaces, such as break rooms or outdoor settings where they should also be able to enjoy adequate daylight and thermal comfort, were the most desired environmental features for staff.

4.5.6. Study 6: Multi-sensory, Nature-Inspired Recharge Rooms Yield Short-Term Reductions in Perceived Stress Among Frontline Healthcare Workers

'Multi-sensory, Nature-Inspired Recharge Rooms Yield Short-Term Reductions in Perceived Stress Among Frontline Healthcare Workers' was published in Frontiers in Psychology Journal in 2020, by David Putrino, Jonathan Ripp, Joseph E. Herrera, Mar Cortes, Christopher Kellner, Dahlia Rizk and Kristen Dams-O'Connor.

The study reported the user's responses to the Recharge Rooms experience in New York City Hospital. The Recharge Rooms was a research initiative implemented by the research team, consisting in converting an empty laboratory into a resting and refreshing place for healthcare workers, in order to reduce their perceived stress levels during the COVID-19 pandemic. The Recharge Rooms was designed following Attention Restoration Theory (ART) principles, where the users experienced natural scenes with projected natural landscapes, low lighting that is tailored in colour to match the projected landscapes, and silk imitation plants, a nature-inspired multi-sensory environment that included high definition audio recordings of nature sounds paired with relaxing music and infusion of oil diffusers.

The users were asked to complete a single-item Likert-style survey to measure their stress level prior to a 15-minute experience. Having experienced the room, they also reported their stress level with the same measurement technique. Furthermore, a well-validated measure of user experience, Net Promoter Score (NPS), was prompted to report by asking how likely they will recommend this experience to a friend. A total of 496 participants completed the survey during the 14-day data collection period.

The result showed that the experience of the Recharge Room reduced the participants' stress levels dramatically. The mean stress level was reported as 4.6 out of 6 before they entered the room, while it was 1.85 out of 6 after the 15-minute experience (Figure 4-9). Moreover, the NPS experience reported a result of 99.3%, so nearly all the participants would recommend this experience.

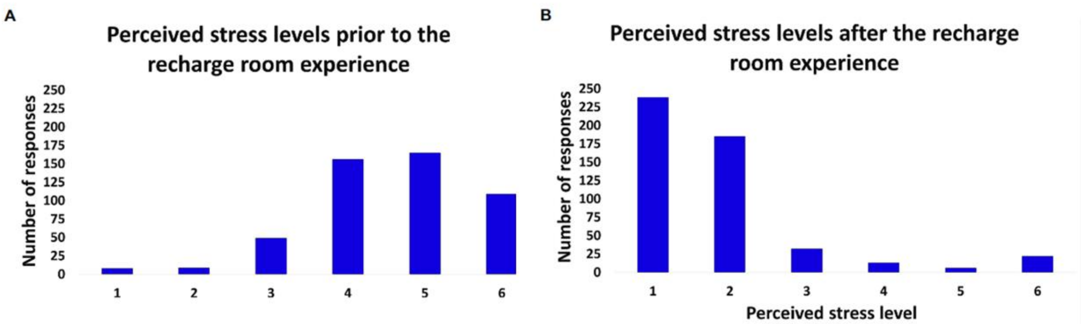


Figure 4-9: Distributions of perceived stress ratings of healthcare workers before (A) and after (B) a 15-minute experience in the Recharge Room (Putrino et al., 2020).

This study revealed the importance of a nature-inspired Multi-Sensory Environment, and the visual perception of Plants and nature scenes to reduce the stress level of the users, even though the installation used artificial and imitating resources of nature. Although there was no recommendation for the application in practice, the study proved the effectiveness of a Multi-Sensory Environment of recharge rooms for healthcare workers.

4.5.7. Study 7: Restorative Design Features for Hospital Staff Break Areas: A Multi-Method Study

'Restorative Design Features for Hospital Staff Break Areas: A Multi-Method Study' was published in Health Environments Research & Design Journal in 2021, by Adeleh Nejati, Mardelle Shepley, Susan Rodiek, Chanam Lee, and James Varni.

This study aimed to investigate the main restorative environmental features of the staff break areas in healthcare settings. A multi-method study was employed by triangulating the qualitative and quantitative data collected for the research. The interviews were conducted with 10 professional nurses in order to gain insight into the environmental characteristics and requirements. An online survey, including both open and closed-ended questions, was delivered to 10,866 healthcare workers, and 993 participants completed the survey within one-month period. The survey also included a visual assessment section where the five variations of a break room, created in photoshop, were asked to be assessed.

The interview participants were recruited among the healthcare consultants of the top 50 healthcare-sector architectural firms in the United States. The interview was designed with 10 open-ended questions to develop an initial understanding of (a) how nursing staff felt about their break areas, (b) how they defined their environmental needs and preferences, (c) what they considered beneficial about taking rest breaks, and (d) what environmental features would meet their needs in break areas. According to the paper, all interviewees reported the necessity and importance of accessing nature and daylight and they appreciated all variety of nature contact ranging from indirect contact via nature-related artwork to the indoor plants within their break areas and a window view of nature such as mountains, gardens, and landscapes.

The interview results reported that the most powerful stress reliever was the provision of direct access to the outdoors, because of the opportunities to direct contact with natural elements (p.23): "to walk in a garden, to be around diverse plants and flowers, to listen to the sound of water, and to receive direct sunlight." A participant described the ideal break area features (p.23): ''they had a beautiful staff lounge and it had a door that opens to a balcony, an outside balcony . . . just the ability to get fresh air, I think they would just love that.''

The informants emphasised the importance of easy and quick access to the outdoors due to the short break time. Seven of the 10 interviewees indicated the refreshing and stress-reducing value of physical access to the outdoor environment during break times.

However, the primary concern was to have quick access back to patients. The study reported that participants offered rooftop gardens where they should have direct access to the nursing unit, and a patio garden which is directly accessible to the staff break rooms and cafeteria. The general idea of desirable indoor break area location followed the same concern, easy and rapid access to patients (p.21):

> *If they're not able to have immediate access back to the unit, like if the break room is not on the unit, then oftentimes they won't take breaks.*
>
> *You need to get away from the unit, at least behind a door so that the noise is not crazy and you're not hearing everything. But that being said, you also can't go very far away because your patients are sick and if you're their nurse, it's really difficult to not be right there.*

The study revealed that visual or physical contact with the outside world and biophilic elements (i.e. View, Prospect, Daylight) played a critical role in obtaining mental relief. The importance of this connection was stated by participants as follows (p.22):

> *When I had a window it made all the difference in the quality of my day, being able to look at out and see what was going on.*
>
> *I think the access to a view or to daylight and to the changing of the time of the day and the seasons is critical to the mental health and well-being of the staff.*

The nurses also frequently indicated a strong need for quiet and private indoor and outdoor spaces, to which the patients and their families would not have access. Privacy and being away from non-staff sight were emphasised by participants (p.22):

> *If you're going to have outdoor access, then I think it does need to be a quiet environment; again, private—it would be a private garden, not a garden like with families and kids running around.*
>
> *It has to be segregated because if families see staff members sitting outside . . . the family members are going to find them.*

Another functional suggestion about the break areas was they should provide completely private time as well as socialising opportunities where they eat and sit in small groups. One participant commented (p.22):

> *I think they need complete privacy because it is part of your decompression time where you're mulling over your life... But it's also a place where they need to*

decompress with what's going on with their patients... So, they need a lot of privacy because it is patient information shared.

Additionally, the interviewees sought comfortable furniture and appropriate appliances in both indoor and outdoor break areas. They suggested comfortable furniture would help to physical relieve from hours of standing and walking. Another suggestion for furniture design was the ability to rearrange the items easily for individual or group activities.

The recommendations to be implemented in practice revealed the three most commonly sought amenities for outdoor break areas to be: comfortable seating, covered patios, and a rich natural environment. The quotations referred to a Multi-Sensory Environment of Greenery and Water elements while defining the perfect condition for a relaxing environment (p.23):

In my perfect world, there would be plants—not anything too crazy that requires a lot of maintenance. There would be a water feature that just gave that noise, that waterfall noise, and then benches to sit on. It doesn't have to be a big walking path because I just don't have time.

Trees, bushes, or flowers that have aroma to them; perhaps access to nature sounds [such as] running water or birds. I mean all of those elements of nature that we know nourish us as individuals.

The survey included 50 open and close ended questions that assessed the existing environmental values in the staff break areas and preferred amenities for future design. The questions were arranged in six categories: (1) demographic information, (2) work environment and experience, (3) rest break patterns, (4) quality of staff break areas, (5) future staff break areas, and (6) additional feedback. The results related to the existing amenities were not included in this analysis since they did not indicate a clear insight into the importance of biophilic design parameters. This survey also examined the additional amenities staff would like to have in breaking areas. Therefore, the word frequency analysis of the preferred environment indicated that the informants used the word 'window' 79 times in responses, considering that only 40.2% of the participants had windows in their break areas.

The survey also revealed that the most desired elements of views from the staff break areas were nature-based: trees, sky, flowers, park-like area and lawn respectively (Figure 4-10).

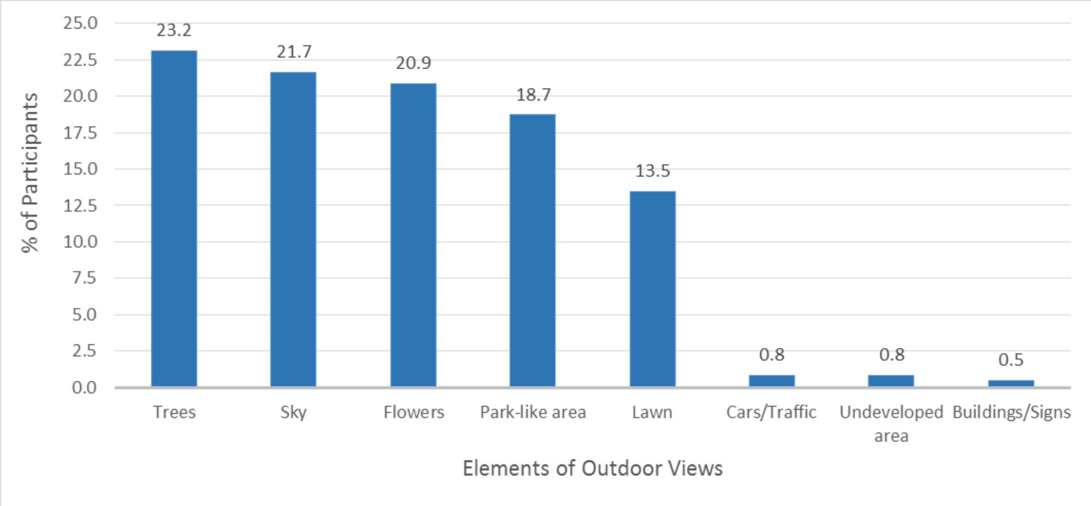


Figure 4-10: Preferred views from break rooms (Nejati, 2015).

Moreover, the importance of privacy was highlighted in the results obtained from the survey. In response to the question about preferences in the break areas, 59.1% of the participants demanded private outdoor break spaces for all staff in the healthcare facility, and 28.8% supported the private break area for only nursing staff, whereas only 10.6% agreed with the idea of a public break area accessible for everybody (Figure 4-11). Considering 87.4% of the existing outdoor break areas were open to the public, the staff was unhappy with the existing privacy conditions.

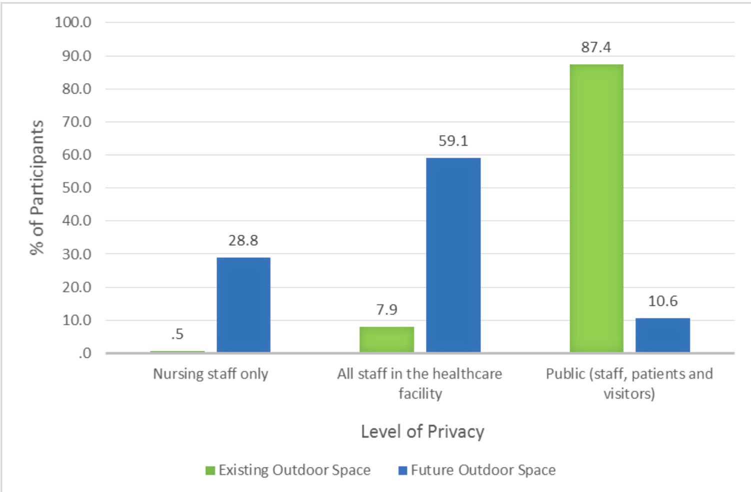


Figure 4-11: Privacy for existing vs. desired outdoor break spaces.

When the participants were asked about additional amenities that they would like to see added to their indoor and outdoor break spaces. The most frequently used word was ‘window’ (79), and the second one was ‘comfortable’ (57). A total of 129 words were related to comfortable furniture, including ‘’sofas’’ (29), ‘’couches’’ (31) and ‘’recliners’’ (35). When expressing their preferences for future outdoor spaces, respondents’ responses indicated (Figure 4-12) that the most desired space configurations were the ones that prioritised privacy and sheltering, like a courtyard, porch, and a roof terrace where only staff allowed to use. The healing garden, patio, atrium, balcony, viewing garden and screened porch were also highly rated by over 8% of participants. Similarly, the data in Figure 4-13 shows that the most desired amenities were seating, plants, flowers, tables, trees, shade, and water features respectively. The study also indicated that preferences for shade, tables, flowers, and water features surpassed the prevalence of those features in existing facilities.

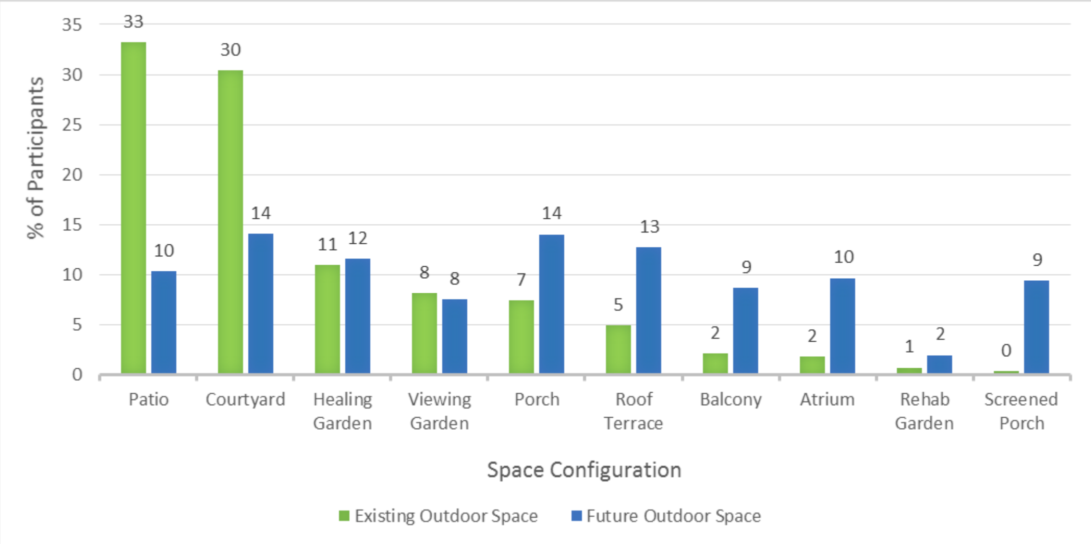


Figure 4-12: Space configuration for existing vs. desired outdoor break spaces (Nejati, 2015).

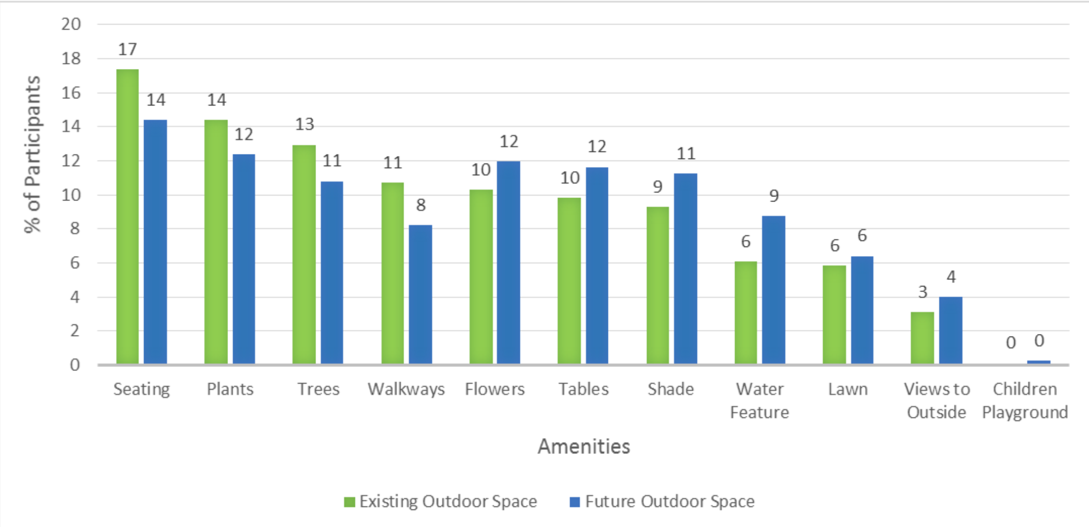


Figure 4-13: Amenities for existing vs. desired outdoor break spaces (Nejati, 2015).

Lastly, the survey asked the participants to rank the stress-reducing restorative qualities of two sets of images that were manipulated photographs of two break room examples.

Both sets of images had five variations: 1) room with a solid wall, 2) room with a plant 3) room with a painting of nature on the wall 4) room with a window 5) room with a balcony.

The results proved that the healthcare staff definitely preferred having physical access to the outdoors, followed by the view through a window, and a painting of nature was preferred over a plant. Although this part of the survey generated an evident hierarchical order, it should not be ignored that this ranking was based on only the visual assessment of images, therefore it might not provide results as reliable as those from real experiences.

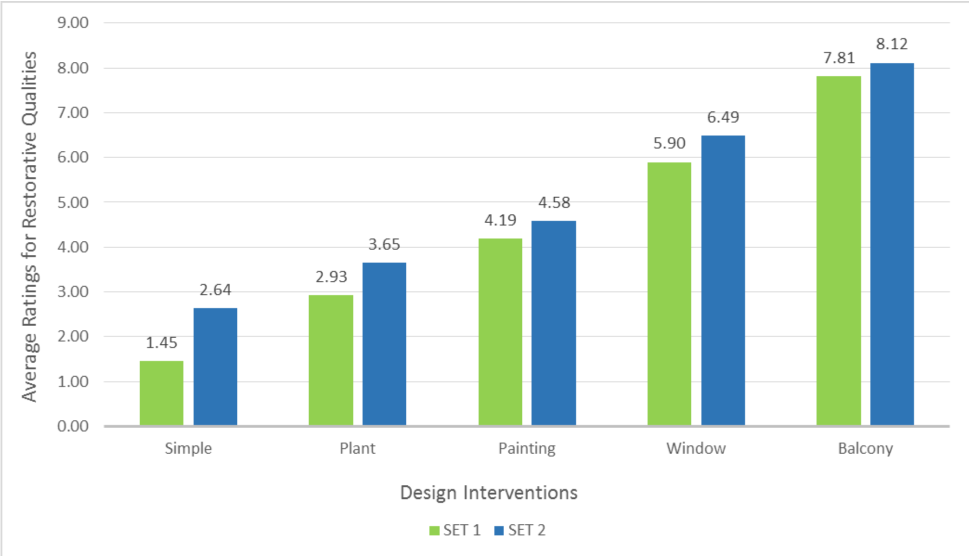


Figure 4-14: Visual assessment of images (Nejati, 2015).

To sum up, overall the most emphasised environmental preferences in a break area were access to the outdoors, where they could benefit from sufficient Natural Light, Fresh Air, Greenery and other unspecified natural elements; accessing nature and daylight were also specified for both indoor and outdoor break areas separately. Once again, the importance of Privacy and Refuge was exceptionally indicated in all cases. View, along with the Prospect, was another critical feature of indoor preferences, however, Prospect was also sought for outdoor spaces. A need for quietness and quiet space during break times emerged in interviews and open-ended surveys. Comfortable amenities and furniture were accepted as a criterion for the restorative quality of the break areas. Lastly, Greenery, Water, and Multi-Sensory Environment were referred to throughout the study.

In terms of recommendations for practical implementation:

- All variety of nature contact should be involved in the design ranging from indirect contact via nature-related artwork to the indoor plants within their break areas and window view of nature such as mountains, gardens, and landscapes. Particularly, view through windows was the most frequently desired feature in indoor break areas.

- Break areas should be well-located in terms of easy and rapid access to the patients, and the outdoor environment. This is one of the most critical applications of biophilic design for the staff, as they are unlikely to have a break if their movement is restricted or challenging between refreshment areas and fieldwork.

- Physical access to outside and natural settings is another crucial intervention, considering its critical role in obtaining mental relief. Porches, courtyards, patios, balconies, terraces, and gardens should be rigorously integrated into the design. The privacy should be seriously considered, particularly private break areas free from patients and their companions. However, these spaces should provide socialising opportunities for staff through spatial organisation and furniture choice. Also, these outdoor areas should be enriched with greenery, trees, shade, tables, flowers, and water features.
- Even though the recommendation for furniture in this study does not refer to biophilic design in a direct way, it contributes to biophilic design by associating to a homely and comfortable environment. Sofas, couches, and recliners were the most frequently mentioned desired furniture. Also, easily rearrangeable furniture for individual or group activities was recommended.

4.5.8. Study 8: Biophilia and Salutogenesis as restorative design approaches in healthcare architecture

'Biophilia and Salutogenesis as restorative design approaches in healthcare architecture' was published in Architectural Science Review journal in 2019, by Mohamed S. Abdelaal and Veronica Soebarto.

This research aims to propose a framework to utilise the therapeutic impact of being in contact with nature in the hospital environment by using biophilia and salutogenesis approaches. A mixed-method was used by combining literature review and case study analysis The Royal Children's Hospital in Melbourne was renovated in 2011 using principles of biophilic and salutogenic design to meet the physical, psychological and social needs of its users.

This study approached the healing environment in a holistic way that proposed to think of the environment with all human needs in mind, and acknowledging that the qualities of the environment can play a noteworthy restorative role in healthcare in all terms: physical, emotional, mental, and spiritual. A need for a holistic approach was critical, as most healthcare institutions' design criteria, guidelines, and medical considerations are only focused on physical recovering, neglecting the other three domains. The study proposed that this holistic restorative healing approach can be possible by implementing biophilic design in the healthcare environment, as biophilic design has the ability to support the physical, emotional, mental, and spiritual needs of human beings. In order to support this hypothesis scientifically, the study examined the biophilic design framework *14 Patterns of Biophilic Design* proposed by Browning et al. (2014), and classified the *patterns* based on the scientific facts that support four human resources (physical, emotional, mental, and spiritual) (Table 4-19).

Table 4-19: The restorative impact of biophilic patterns on the four types of human resources *(Abdelaal & Soebarto, 2019)*.

Human Resources	Associated biophilic pattern(s)	Benefits according to key literature
Physical	Visual connection with nature (VC)	Reduced occurrence of illness (infection) (Bringslimark et al., 2007; Colley et al., 2016); shorter stay (Ulrich, 1984)
	Complexity & order (CO)	Decreased stress (Q. Li et al., 2008)
	Thermal & airflow variability (NVC)	Pain relief, social restoration (Reeve et al., 2017); positive impact on well-being and work performance (Lamb & Kwok, 2017).
	Prospect & refuge (P&R)	Improved productivity (Romm & Browning, n.d.); improved ability to perform tasks (Han, 2008)
	Dynamic & diffused light (DL)	Lower heart-rate variability (Stefani et al., 2016)
	Connection with natural systems (CNS)	Reduced headaches (Hansmann et al., 2007)
Emotional	Presence of water (W)	Facilitates social interaction; social empowerment (Zelenski & Nisbet, 2012); positive emotional responses (Windhager et al., 2011); reduced anger/frustration (Grafetstätter et al., 2017; Kuo & Sullivan, 2016a)
	Connection with natural systems (CNS)	Increased self-esteem (Pretty et al., 2006); improved mood (Shibata & Suzuki, 2002)
	Visual connection with nature (VC)	Positive impact on attitude & overall happiness (Korpela et al., 2017)
	Non-visual connection with nature (NVC)	Pleasure and satisfaction (Pallasmaa, n.d.)
	Thermal & airflow variability (TFV)	Improved perception of temporal and spatial pleasure (alliesthesia)

		(Parkinson & de Dear, 2012)
	Prospect & refuge (P&R)	Reduced boredom, irritation, fatigue (Clearwater & Coss, 1991)
	Risk (R)	Strong dopamine or pleasure response (X. Wang et al., 2016)
Mental	Mystery (M)	Improved concentration, attention and perception of safety (X. Wang et al., 2016); reduced mental fatigue (M. Moore et al., 2006)
	Non-rhythmic sensory stimuli (NRS)	Positive distraction (Jiang et al., 2017)
	Prospect & refuge (P&R)	Stress reduction (Day & Rich, 2009)
	Complexity & order (C&O)	
	Biomorphicforms & patterns (BFP)	
	Non-visual connection with nature (NVC)	Reduced anxiety (X. Wang et al., 2016)
Spiritual	Dynamic & diffused light (DL)	Fosters imagination (Glăveanu et al., 2014); promotes creativity (Steidle & Werth, 2013)
	Biomorphic forms & patterns (BFP)	Spiritual restoration and inspiration (Pretty, 2004)
	Visual connection with nature (VC)	Therapeutic spiritual inspiration (L. M. Fredrickson & Anderson, 1999)
	Non-visual connection with nature (NVC)	Enhances spiritual experience (Heintzman, 2013); greater awareness and empowerment (Lehman, 2011)
	Material connection with nature (MCN)	Increased inspiration (L. M. Fredrickson & Anderson, 1999)

The second step of the research examined The Royal Children's Hospital in Melbourne, as the case study, using official care and performance reports, online images, virtual tours and architectural magazines. The study defined that the forms, colours, patterns, and spatial arrangements of the hospital were inspired by the natural world in order to provide a stimulating and therapeutic environment for children, staff, and the general public. Many parts of the hospital's design were derived from the nearby Royal Park's bushland environments. The study observed that courtyards, a sweep of coloured 'leaves,' panoramic vistas of the parks, a two-story coral reef aquarium, large-scale artworks, and a miniature zoo were all employed to maximise the connection to nature. According to the reports examined in this study, compared to the condition prior to renovation, these new design ideas have significantly reduced the hospital's users' pain, worry, and anxiety by normalising tactile and engaging environmental experiences.

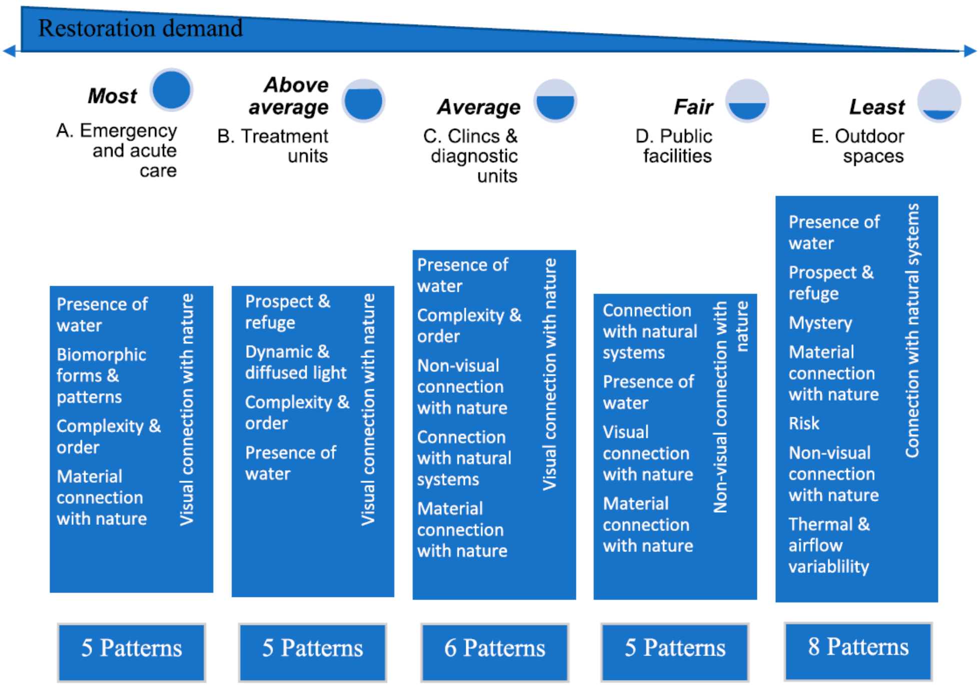
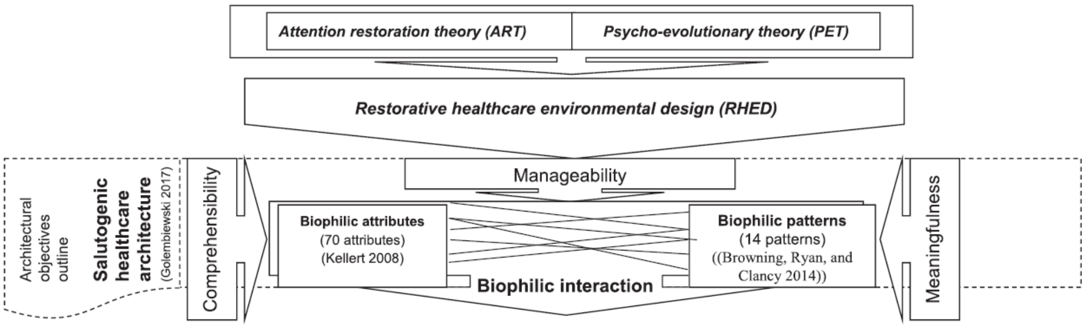


Figure 4-15: The correlation between biophilic patterns and attributes and the hospital's restorative zones to be used in the framework *(Abdelaal & Soebarto, 2019).*

Finally, the study proposed a framework for restorative healthcare environment design that considered the 14 patterns of biophilic design based on four human sources in different zones and specific areas of the healthcare environment where stress, depression and anxiety symptoms are most likely to affect patients, families or caregivers in different levels (Figure 4-16). The study classified hospital zones into five categories according to the intensity of stressors: *(a) high-risk emergency departments, intensive care units and operating theatres; (b) day surgery and cancer treatment units ; (c) diagnostic clinics and imaging departments; (d) common spaces including lounge areas and social spaces, which can mitigate the level of stress within hospitals; and (e) outdoor therapeutic gardens, which can be an indispensable source of restoration and recovery* (Figure *4-15*).



		Stress Zones in healthcare services (ordered according to the potential level of stress for patients and medical staff from A (highest) to E (lowest))									
		(A) Acute care settings (emergency, ICU, operating theatre)		(B) Treatment and recovery setting (patients' room)		(C) Diagnostic settings (clinics, imaging, labs,)		(D) Common facilities settings (reception, cafeteria)		(E) Outdoor spaces	
Patient & Staff	Physical	VC, C&O	Low restorative impact (9 attributes)	VC, C&O, DL, CNS	High restorative impact (11 attributes)	VC, NVC, CNS, C&O	Average restorative impact (12 attributes)	VC, NVC, CNS	Average restorative impact (11 attributes)	P&R, NVC, CNS	High restorative impact (11 attributes)
	Emotional	W, VC, P&R		W, VC, P&R		VC, NVC, CNS, W		VC, NVC, CNS, W		W, CNS, NVC	
	Mental	C&O		P&R, C&O		NVC, C&O		NVC		P&R, NVC, M	
	Spiritual	BFP, MCN, VC		DL, VC		VC, NVC		VC, NVC, MCN		NVC, MCN	

Figure 4-16: Proposed restorative healthcare environmental design framework *(Abdelaal & Soebarto, 2019)*.

The classified framework based on the results of the systematically searched review and case study analysis, shown in Figure 4-15 and Figure 4-16, exposed those biophilic design patterns that were claimed to help to treat humans physically, emotionally, mentally, and spiritually from the most restoration demanded hospital zone to the least one. Despite the fact that the scientific facts relevant to biophilic design patterns that support the physical, emotional, mental, and spiritual wellbeing were defined in Table 4-19, the paper did not explain what were the contributions and main drivers of this selection and classification of the patterns in particular healthcare areas in detail. Once looking at the restoration demand level, the result indicated a ranking between biophilic design patterns, the framework shows that the presence of water, biomorphic forms and patterns, complexity and order, and material connection with nature are more important than the other parameters since they were used in the treatment of the most restoration demanded zones. However, the fact should not be ignored that these zones have different spatial requirements, patient conditions, and staying duration. Furthermore, the study was not able to inform enough about the environmental features in the case study, and the answers could not be found about which features and amenities impacted the users and in which way the particular features impacted them, although general impact (reduced the hospital's users' pain, worry, and anxiety) of the renovation with natural features were explained. Finally, the quality assessment appraisal (see section 4.6) classified this study as low quality for this systematically searched review, but the data were used to consider the reliability of the data collected from previous papers.

4.5.9. Study 9: Healthcare Settings

'Healthcare Settings' was published as a chapter in the book *'Environmental Psychology and Human Well-Being: Effects of Built and Natural Settings'* in 2018, by KarinTanja-Dijkstra and Cláudia Campos Andrade.

Although book chapters were excluded in the search, this study was included in the systematically searched review because it was written in academic journal article format and published by Elsevier Inc. the paper also evaluated cancer patients' preferences and satisfaction in relation to two case studies of oncology therapeutic environments.

The first case study, which was reported in a journal paper in 2017 (D. K. Tanja-Dijkstra et al., 2017) (excluded in the systematically searched review search because the paper was published in Dutch), examined a garden pavilion designed for cancer patients to receive chemotherapy on the grounds of a Dutch hospital. The pavilion was constructed with a timber structure and glass roof, allowing users a view of the greenery in the garden and the sky, and it was bespoke furnished, trying to maximise comfort. A questionnaire was completed by 62 patients during their therapy sessions, either in the hospital chemotherapy room or in the pavilion. The majority of the participants preferred treatment in the garden, indicating that they enjoyed the nice weather, nature, and fresh air as the most important reasons. Those who received therapy in the pavilion also reported that the environment affected them slightly more positive and that the connection with natural elements evoked restorative feelings.

The second case was cancer care units designed by the Teenage Cancer Trust in some UK hospitals, including Queen Elizabeth Hospital in Birmingham and Royal Hospital for Children in Glasgow. These units were carefully designed for young people in deep detail, with the intention to create a relaxed and comfortable home-like environment and maintain a sense of normality. The reports produced by the same trust were examined in this study. Comments from the reports defined the environment in the following way (p. 326-327):

> *The walls are bright, the furniture is funky, and there's often a social space, Wi-Fi access, flat-screen TVs, Xboxes, and jukeboxes. You might walk into a unit and find a game of pool going on, someone chatting to friends online, or a photography workshop going on.*

The paper claimed that five aspects contributed to the positive impact of these environments: control of the environment, comfort, stimulation, personalization, and being connected. Nonetheless, no more details about these inferences were given in the paper. However, the authors claimed that these attributes were matched with the dimensions of Ulrich's Supportive Design Theory (see Chapter 3): perceived control, positive distraction (simulation), and social support (being connected).

To sum up, the first case showed the patients' preferences towards natural elements with the mention of fresh air, view, visual connection with nature, greenery, plants, and nice weather (light and seasonal changes) in order to experience more positive and restorative feelings. While the second case indicated the importance of feeling comfortable and relaxed in a home-like environment, and a sense of normality to handle stress and anxiety. Unfortunately, this study did not comprehensively inform this work as it does not report original peer-reviewed research but rather, an analysis of two cases forming a book chapter. Therefore, the lack of information and methodology about the examples led this work to be classified as low quality within the scope of this systematically searched review (see section 4.6). Nonetheless, the data were kept as supportive knowledge of the data compiled from other papers.

4.6. Quality Assessment

After selecting the studies in accordance with the inclusion and exclusion criteria, the process follows the data extraction step. However, it is recommended to assess the quality of the selected studies in order to consider the reliability of the data before deciding on the final results (Boland et al., 2017). The meaning of term "quality" in systematic review methodologies is defined by Khan et al., (2003) as "*The degree to which a study employs measures to minimise bias and error in its design, conduct and analysis".*

Even if the included studies were published in peer-reviewed journals, they shouldn't be deduced as free of biased. The quality assessment is not a mandatory step for a systematic review, but it is crucial for reliability since the assessment and appraisal of the selected studies give the review results confidence, reliability and trustworthiness (Boland et al., 2017). Scheduling and deciding the timeline of the quality assessment depends on the reviewer. The time of quality assessment can be implied after or before the data extraction during the progress. It may be carried out *before the data extraction* in order to exclude poor-quality studies. However, assessing the quality *after the data extraction* is also strongly advised as the reviewer will be blind to study quality, thus, the reporting is less likely to be biased. Also, assessment after the extraction will help to answer the quality assessment questions with a greater familiarity with the examined studies (Boland et al., 2017). Therefore, the quality appraisal in this systematically searched review was carried out after the stage of data extraction, but before synthesising the results. The data extracted from the poor-quality studies were not eliminated and were considered as controlling criteria with the data from higher-quality publications. However, the quality of the studies was considered for creating the final evaluation of the biophilic design parameters.

Table 4-20: The quality assessment of selected studies.

	Quality Assessment Questions	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**
Research Question and Design	Was there a clear and sensible research question?	✓	✓	✓	✓	✓	✓	✓	✓	x
	Was the research design appropriate?	✓	✓	✓	✓	✓	✓	✓	✓	NA
Sampling	Was the sampling frame sufficient and representative?	✓	✓	✓	✓	✓	x	✓	NA	NA
	Did all the participants understand what was required?	✓	✓	✓	✓	✓	✓	✓	NA	NA
Instrument	Did questions cover all relevant aspects of the problem in a non-threatening and non-directive way?	✓	✓	✓	✓	✓	✓	✓	NA	NA
	Were qualitative (open-ended) or quantitative (closed-ended) questions used appropriately?	✓	✓	✓	✓	✓	✓	✓	NA	NA
	Was a pilot version administrated to the participant's representative and modified accordingly?	NA	NA	✓	✓	✓	NA	✓	NA	NA
Response	Was the response rate reported?	✓	NA	✓	✓	✓	✓	✓	NA	NA
	Were non-responders accounted for?	✓	NA	✓	x	✓	✓	✓	NA	NA
Coding and Analysis	Was the analysis appropriate and were the correct techniques used?	✓	✓	✓	✓	✓	✓	✓	✓	NA
Presentation of Results	Have all relevant results been reported?	✓	✓	✓	✓	✓	✓	✓	✓	NA
	Is there any evidence of data dredging (analyses that were not hypothesis-driven?)	x	x	x	x	x	x	x	x	x
Relevance	Can the document assist in the	✓	✓	✓	✓	✓	✓	✓	✓	✓

	synthesis process in leading to clarity on the effect of the intervention in achieving the outcome?	

The quality assessment tool in this systematically searched review was adopted from the study developed by Holloway Cripps (2016) who created a checklist based on PRISMA guidelines and modified in accordance with the systematic review guidelines from Boland et al., (2017), in which the reliability of the studies is assessed through 13 questions forming a checklist. Table 4-20 shows the quality assessment questions and the corresponding answers obtained from each study. According to this checklist, Study 3, Study 5, and Study 7 were considered High-Quality studies in terms of reliability, since they were able to respond positively to all questions. However, Study 1, Study 2, Study 4, and Study 6 could not satisfactorily respond to one, three, one, and two questions respectively. Broadly speaking, the general reason was unknown information, stated as Not Applicable (NA), this meant that no explanation or mention of the requested information from the quality assessment questions was found in these studies. Accordingly, these four studies were classified as only Good Quality. Study 8 could not answer the majority of the questions because of the methodological inappropriateness of this systematically searched review. It was a review study that proposed a holistic framework for hospitals in general, and its case study did not employ primary data from users but used reports and online visual sources. Study 9 also presented a general review of the healing environment, which provided partial summarised data related to the analysed case studies, and did not provide detailed information about the case studies' stages and processes. Although these two last studies were considered Poor Quality in terms of reliability for this systematically searched review, they were kept as a control group for assessing the results obtained from the other seven studies.

4.7. Synthesis of the Biophilic Design Parameters

The analysis of the selected studies proved that clinical settings cannot be examined as one whole environment in terms of the users' requirements and the importance of biophilic design parameters. The clinical spaces assessed in the studies were places where patients received treatment as well as working environments for the staff. Therefore, this systematically searched review study examined biophilic design parameters in clinical environments from two different perspectives: patient-based perspective and staff-based perspective. Within this classification, further differentiation was determined to be needed, as the analysis revealed some differences in environmental perception between the inpatient users and outpatient users. Thus, the synthesis was also carried out separately considering inpatients' and outpatients' needs for a biophilic environment. The classification of the most important biophilic design parameters in clinical environments, as obtained in the synthesis from the selected studies in the systematically searched review is illustrated in Figure 4-17. The following sections in this chapter analyse these results, according to each of the three groups of users.

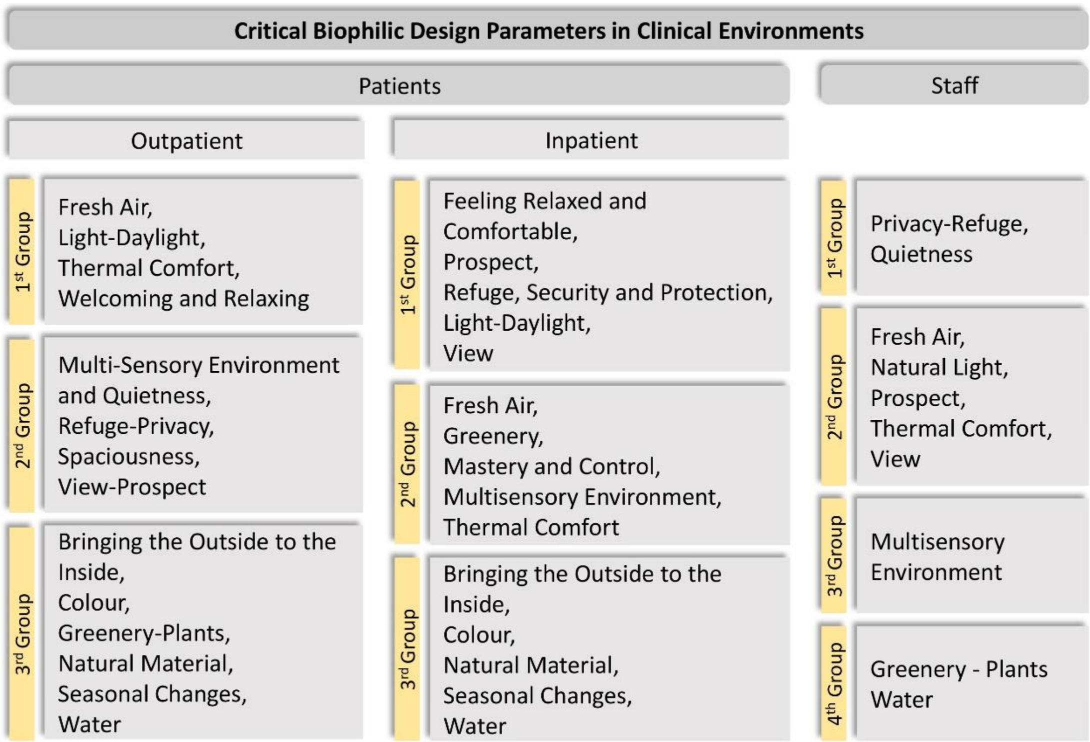


Figure 4-17: Classification of the identified biophilic design parameters in a clinical environment based on the *systematically searched review*.

4.7.1. The Prominent Biophilic Design Parameters in Clinics for Patient-Based Perspective

In terms of the patient-based perspective, the studies focused on the most commonly used spaces by cancer patients in clinical environments. Therefore, the data obtained gave an extensive insight into chemotherapy units, waiting rooms, wards/rooms, outdoor areas accompanying hospitals or clinics, and doctor/diagnosis rooms. The studies that recruited outpatient participants (Studies 2, 5, 8, 9) mainly focused on chemotherapy units and waiting rooms as well as doctor rooms. On the other hand, in the inpatient-based studies, the main focus was ward or hospital room environments and, in some cases, outdoor areas for patients who can go out for refreshment (Studies 1, 3, 4, 8, 9).

4.7.1.1. Preferred Clinical Environment for Outpatient Cases

The data in relation to the outpatients' perspective was collected from four studies. While Study 8 and Study 9 employed both inpatient and outpatient participants, Study 2 reported data for only outpatients and Study 5 had both outpatient and staff perspectives. The results showed variations depending on the studies because of the directed questions, different approaches and existing environment of the population, and the scope of the studies. Although these differences in the results made the progress more complicated in terms of extracting general conclusions and obtaining a clear ranking of biophilic design parameters, they contributed to making the study more extensive and less biased.

As shown in Table 4-21, while Study 5 studies presented a hierarchy between the important biophilic design elements, the other studies only indicated important parameters without ranking them. Therefore, this synthesis ranked the biophilic design parameters (holistically by groups, based on the importance levels reported in the studies as well as taking into account the reliability and quality of the studies, as examined in section 4.6). For example, although the data from Study 8 and Study 9 gave an insight into important parameters, the ranking prioritised Study 2 and Study 5's results because the unknown criteria in the quality assessment of these two studies made them less reliable than others.

Table 4-21: Important biophilic design parameters for outpatient environments in the studies.

<table>
<tr><th>Ranking</th><th>Study 2</th><th>Study 5</th><th>Study 8</th><th>Study 9</th></tr>
<tr><td>1st</td><td rowspan="3">Welcoming,
Relaxing, Calming
and Restful Feelings
Fresh Air, Light,
Spaciousness,
Plants, Water,
View, Sensory
Richness, And
Quietness
Privacy-Refuge</td><td>Thermal Comfort
Natural Light
View of Nature</td><td rowspan="3">Presence of Water,
Complexity and
Order
Non-Visual
Connection with
Nature
Connection with
Natural Systems
Material
Connection with
Nature</td><td rowspan="3">Fresh Air, View,
Visual Connection
with Nature,
Greenery, Plants,
Light and Seasonal
Changes</td></tr>
<tr><td>2nd</td><td>Privacy
Quietness
Pictures of Nature</td></tr>
<tr><td>3rd</td><td>Plant-Greenery</td></tr>
</table>

The synthesised groups of the biophilic design parameters for a clinical environment for outpatient users are summarised in Table 4-22. Even though all these parameters were explicitly commented on by outpatient participants as required biophilic design parameters, some of them were emphasised and reported as more critical. Therefore, three different groups were created in order to hierarchise these biophilic design parameters. The parameters within the groups were listed alphabetically regardless of any ranking since there was no exact comparison of parameters in the examined studies. The first group consisted of the parameters that were commonly indicated as the most important features in the centres: Fresh Air, Light-Daylight, Thermal Comfort and Welcoming and Relaxing. Multi-sensory Richness and Quietness, Refuge-Privacy, and Spaciousness were classified in the second group. Lastly, Greenery-Plants was classified in the third group because Study 5 clearly stated that it was one of the less rated features by patients. Bringing the Outside to the Inside, Colour, Natural Material, and Seasonal Changes were the other important parameters in this third group.

These specified biophilic design parameters should be taken into account to create stress-reducing, relaxing and comfortable environments for outpatients in cancer clinics. The outstanding spatial and environmental requirements for these clinical settings were summarised from the examined studies as:

- Waiting rooms need to have access to outdoor spaces as well as contact with natural elements inside since patients have a strong need to be relaxed and refreshed while waiting for therapy or diagnosis.
- Waiting rooms or commonplaces should offer private zones for patients and their families as well as minimise separation from the non-cancer population in order to reduce the feeling of isolation.
- Treatment rooms should have a more visual and sensorial connection with the outside and natural elements and create opportunities for interacting with other patients.
- Diagnosis rooms should be well designed to be restorative, comfortable and spacious since the environment strongly affected the patients psychologically as they considered the quality of the atmosphere guides a self-deprecating- feeling at a time that is a turning point in their life.

Table 4-22: Important biophilic design parameters for outpatients in clinical settings based on synthesis results.

Importance Level	Biophilic Design Parameters
1st Group	Fresh Air Light-Daylight Thermal Comfort Welcoming and Relaxing
2nd Group	Multi-sensory Richness and Quietness Refuge-Privacy Spaciousness View-Prospect
3rd Group	Bringing Outside to Inside Colour Greenery-Plants Natural Material Seasonal Changes Water

4.7.1.2. Preferred Clinical Environment for Inpatient Cases

Five of the examined studies reported data about the environmental needs of inpatients, particularly in oncology settings. Study 1, Study 3 and Study 4 focused only on inpatients' environments. While Study 1 and Study 4 collected data directly from cancer patients, Study 3 used professional experts' views. On the other hand, Study 8 and Study 9 employed data from both inpatient and outpatient groups. The important biophilic design parameters extracted from these five studies are shown in Table 4-23.

Table 4-23: Important biophilic design parameters for inpatient environments in the studies.

Ranking	Study 1	Study 3	Study 4	Study 8	Study 9
1st	Greenery-Plants, View-Prospect, Welcoming-Relaxing, Light	View, Prospect, Refuge, Light	Refuge, Feeling Comfortable, Feeling Relaxed, Security and Protection	Presence of water, Biomorphic forms and patterns, Complexity and order Material connection with nature	Feeling comfortable and relaxed
2nd	Multi-sensory Environment Water, Air	Greenery, Multi-sensory Environment, Fresh Air	Daylight	Prospect and Refuge Light	
3rd	Bringing the Outside to the Inside, Material Colour Spaciousness	Feeling Safe, Feeling Relaxed	Thermal Comfort, Mastery and Control		
4th		Natural Material, Natural Colour	Greenery, Multi-sensory Environment, Fresh Air		
5th		**(Only Visual Perception Described)** Seasonal Changes, Outside-Inside Effect, Water	Sense of Belonging		

Even though the important parameters for inpatient-based environments were not quite much different from outpatient-based environments, the detected priority differences may impact the environmental quality since the function of the spaces and patients' physical conditions are different. The synthesised groups of the important biophilic design parameters for a clinical environment for inpatient users are summarised in Table 4-24. Even though all these parameters were specified as required biophilic design parameters by patients and experts, some of them were emphasised and reported as more critical. Therefore, three different groups were created in order to hierarchise these biophilic design parameters. As before, the parameters within the groups were listed alphabetically regardless of any ranking since there was no exact comparison of parameters in the examined studies. Regarding the patients who are usually spending their time in the wards or hospital rooms on their beds, the most important parameters were View, Prospect, and Daylight through windows. Therefore, the beds' position and connection with windows were important to apply these biophilic features efficiently. Another outstanding parameter in the first group was Refuge, Security and Protection as the patients need to feel safer because of their unforeseeable health conditions, fear of death, and desperate neediness for unfamiliar people (healthcare workers). Lastly, Feeling Relaxed and Comfortable, and Welcoming was the last parameter of the first group. The second group consist of Fresh Air, Greenery, Mastery and Control, Multi-sensory Environment, and Thermal Comfort. Finally, the third important group of biophilic design parameters included Bringing the Outside to the Inside, Colour, Natural Material, Seasonal Changes, and Water. However, it should be considered that these parameters were usually mentioned in the studies for their visual impact, not for physical contact as these patients' movement is quite restricted, but the studies also sought access to outdoor settings where it is compatible with the patients' health condition.

Table 4-24: Important biophilic design parameters for inpatients in clinical settings based on synthesis results.

Importance Level	**Biophilic Design Parameters**
1st Group	Feeling Relaxed and Comfortable, Prospect, Refuge, Security and Protection, Light-Daylight, View
2nd Group	Fresh Air Greenery, Mastery and Control, Multi-sensory Environment, Thermal Comfort
3rd Group	Bringing Outside to Inside Colour Natural Material Seasonal Changes Water

4.7.2. Biophilic Design Parameters in Clinics for Staff-Based Perspective

The most important biophilic design parameters in clinical environments were examined from the staff point of view separately, as their needs were different from those of patients, being these environments their workplaces. The studies in relation to staff (Studies 5, 6, 7) mainly examined the restoring characteristics of spaces with a particular focus on break areas. Study 6 and Study 7 collected data about staff break areas, while

Study 5 assessed the clinical environment from both patient and staff points of view. The biophilic design parameters extracted from these three studies are shown in Table 4-25.

The synthesised groups of the biophilic design parameters for a clinical environment for staff are summarised in Table 4-26. Like in patients previously examined, all these parameters were stipulated as required biophilic design parameters by staff participants, some of them were emphasised and reported as more critical in the examined studies. Therefore, four different groups were created in order to hierarchise the most relevant biophilic design parameters. Once more, the parameters within the groups were listed alphabetically regardless of any ranking since there was no exact comparison of parameters in the examined studies.

Table 4-25: Important biophilic design parameters for staff in the studies.

Ranking	Study 5	Study 6	Study 7
1st	Privacy-Refuge, Quietness	Nature-Inspired Multi-sensory Environment, Visual Perception of Plants, Nature Scenes (View)	Physical Access to the Outdoor, Natural Light, Fresh Air, Greenery, Privacy and Refuge, View-Prospect
2nd	Thermal Comfort, Natural Light		Quietness, Comfortable Amenities and Furniture
3rd	View of Nature		Indoor Plants, Water, Multi-Sensory Environment
4th	Plant-Greenery		

The results showed that the staff's requirements for the environment had obvious differences from those of the patients. The most outstanding demands were Privacy and Refuge, and the need for Quietness was also frequently emphasised. The studies indicated the importance of physical access to the outdoor environment. The second group represented this demand, which consisted of five biophilic design parameters: Fresh Air, Natural Light, Prospect, Thermal Comfort, and View. Multi-sensory Environment were placed in the third group because Study 6 prioritised it. Whereas Greenery was classified in the fourth group because Study 5 indicated that plants and greenery were not important for the participants. Study 7 also ranked indoor plants in break areas very low, although the same study referred to the visual impact of greenery during outdoor breaks. The fourth group also included Water elements.

Table 4-26: Important biophilic design parameters for staff in clinical settings based on synthesis results.

Importance Level	**Biophilic Design Parameters**
1st Group	Privacy-Refuge, Quietness
2nd Group	Fresh Air, Natural Light, Prospect, Thermal Comfort, View
3rd Group	Multi-sensory Environment
4th Group	Greenery - Plants Water

4.8. Concluding Remarks

The synthesis of findings in this chapter helped to identify and rank the biophilic design parameters that appear the most critical for promoting and supporting human health and wellbeing in clinical therapeutic environments, within and across three different user categories: Outpatients (Fresh Air, Light-Daylight, Thermal Comfort, Welcoming and Relaxing); Inpatients (Feeling Relaxed and Comfortable, Prospect Refuge, Security and Protection, Light-Daylight, View); and Staff (Privacy-Refuge, Quietness). This review also showed that inpatient, outpatient and staff users had similar desires but sometimes divergent priorities and requirements and that the provision of the same or similar biophilic elements to different groups could support distinct affordances.

The main limitation of this review was that not all the examined studies had as their main aim to produce data directly related to the assessment of biophilic design but rather to general hospital design environments. However, this could also be a benefit allowing a better understanding of the value of nature-based design and where it fits within general healthcare design. It was also noticed that the available case studies were limited in number, however, they were systematically selected based on the criteria. This stringent selection is actually very important, because it frames the research to meet this research's specific goals, and provides the necessary rigour to produce a substantive contribution to this early literature by revising it within this specific frame. The selected studies were localised in industrialised Western countries and typically of less than high methodological quality. Studies 8 & 9, showing the lowest level of reliability, proved not to contradict the high-quality studies but did not offer any further evidence to the synthesis, having no input into the design recommendations. Climate and culture influence human perceptions of nature, so as more research is conducted in various regions, climates and cultures, a wider range of data will contribute toward more effective biophilic design frameworks.

Having examined clinical therapeutic environments with a systematically searched review, the following chapter investigated non-clinical therapeutic environments with the case of Maggie’s Centres.

CHAPTER 5

5. A META-SYNTHESIS: ANALYSING PRIMARY DATA FROM EXISTING RESEARCH ON MAGGIE'S CENTRES

This study aimed to look into Maggie's Centres' architectural features and how these features impacted the users' who were affected by cancer and members of staff from their perspective and to discover their opinion and experiences about Maggie's Centres' buildings and architectural objectives (See section 3.4). Originally, this study planned to obtain these data using semi-structured interviews and ethnographic observations, a qualitative research method where the researcher observes or interacts with participants in their usual daily environment (Denzin & Lincoln, 2011). Given the restrictions experienced during the Covid-19 pandemic[1], a new approach was envisioned to still collect and analyse this type of data.

Up to this date, several researchers had studied Maggie's architecture in different contexts and with diverse focuses, and this information had been published extensively. These publications included ethnographic studies comprising interviews, focus groups, observations and questionnaires directed to this specific audience. Although all these studies examined Maggie's Centres' architecture and their healing features, they have not employed a particular focus on biophilic design theory and its parameters. Thus, a great amount of data was lying in all these documents but had not been examined through a biophilic lens. Particularly, direct quotation speeches from users and architects obtained via interviews and focus groups may be considered primary data, as they have not been processed by other researchers. The obtained data were examined and strained by considering the main biophilic design parameters defined in Chapter 2, and the observed parameters and their interrelations were analysed in order to hierarchise them based on reference frequency from the user's perspective which is an important input as including end-users' view in the design provides a successful path (Chrysikou, 2018).

This methodology follows a systematic search strategy, analytical data extraction and classification, and interpretive result analysis.

5.1. Search Strategy and Screening

Initially, a scoping search was conducted in December 2020 to provide an overview of relevant literature and insight into the databases that could be used to carry out a systematic search to export studies related to Maggie's Centres' architecture. After

[1] As a result of the COVID-19 pandemic, all on-site case studies were cancelled by the University of Liverpool Senior Management Team from 19.03.2020 to 12.10.2021. Likewise, the Maggie's Centre Research Advisory Group stated that Maggie's Centres were not in a position to support any research during the pandemic.

conducting an initial plot search, the databases Scopus, Web of Science, JSTOR, ProQuest, ScienceDirect and Ebscohost through the University of Liverpool Library were selected to search the relevant literature systematically, since these databases provided appropriate results that were able to answer the searching goal.

The resources were restricted to academic journals, conference material, master and doctoral theses, and architectural magazines, and only architectural news was excluded since the initial search proved that the news had not provided related primary data. The main aim was to compile all publications relevant to Maggie's architecture, so the selected keywords used in a basic searching syntax were: "Maggie's centre" AND (architecture OR building OR design OR environment). While selecting sources, the "population" was limited to studies that focused on patients, staff and visitors who used these therapeutic spaces on a regular basis, as well as designers of any of the Maggie's Centres. The most crucial inclusion criteria were direct quotations related to Maggie's architecture, so all data had to be scanned regardless of their results or research objectives since the data were extracted from the methodological processes for this meta-synthesis.

The main search was conducted on 14th December 2020 using six databases. The language was limited to only English, and the search period went from 1996, when the first Maggie's Centre was opened in Edinburgh, to the search date (14th December 2020). A total of 97 publications were exported to Rayyan QCRI software. Table 5-1 shows the search records and the number of results exported for screening.

Table 5-1: The search record of databases and the number of results.

Date Performed	Database	Search Syntax	Number of Results
14.12.2020	Web of Science	"Maggie's Centre" AND (architecture OR building OR design OR environment)	2
14.12.2020	Scopus	"Maggie's Centre" AND (architecture OR building OR design OR environment)	17
14.12.2020	JSTOR	"Maggie's Centre" AND (architecture OR building OR design OR environment)	6
14.12.2020	Ebscohost	"Maggie's Centre" AND (architecture OR building OR design OR environment)	44
14.12.2020	ProQuest	"Maggie's Centre" AND (architecture OR building OR design OR environment)	7
14.12.2020	ScienceDirect	"Maggie's Centre" AND (architecture OR building OR design OR environment)	21

After removing 10 duplicates via the Rayyan QCRI software duplicate removal system, the initial screening consisted of reading abstracts and, in some particular cases, checking full texts. All review papers and non-architectural studies, such as medicine-based cancer studies, were excluded. Thus, 18 studies were employed for the full-text reading stage, while 69 papers were excluded (Figure 5-1). At the same time, the researcher also contacted the Maggie's Centres Research Advisory Group, to learn about prior research studies on Maggie's, which they kindly provided. After obtaining this information, some of these researchers were contacted directly to collect information about their publications. They recommended 11 publications that provided primary qualitative data. Hereby, along with the 18 papers, six of which were also recommended by members of the Advisory Group and researchers themselves, another five publications were included for full-text reading.

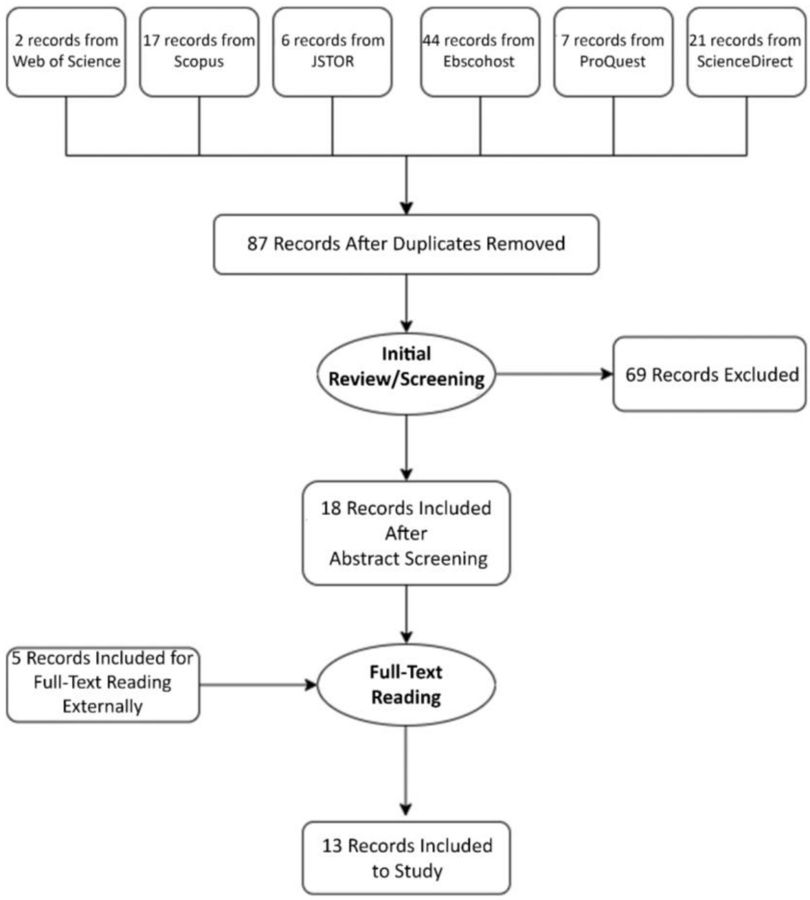


Figure 5-1 Identification of included articles in the review.

During the full-text reading of these 13 publications, the focus was on the primary data which generally exists as direct quotations. The main difference with a systematic review methodology was that the topic, objectives or results of the studies in question were not important facts for this review. The straightforward aim of this method was to extract primary data from secondary sources and examine this data from a biophilic standpoint.

Thirteen documents were included in the final full-text reading stage: one PhD thesis, one conference poster, three conference proceedings, one book chapter, three architectural magazine articles, and four academic journal papers (Table 5-3). These 13 resulting documents were imported to Nvivo 12, a qualitative data analysis software. Although MaxQDA and Atlas.ti are software which have quite similar analysing systems, these software were selected since the University of Liverpool has a licensing protocol.

5.2. Data extraction and Analysis

All 13 documents were analysed in NVIVO 12 software by creating codes. The codes represent in connection with the contents of the data by considering biophilic design elements and their impacts on human health and wellbeing. Therefore, biophilic design and other architectural design elements that were used by designers as intervention tools for the environment were considered “Interventional” codes; and all feelings, mental and salutogenic impacts caused by the *Interventions* were referred to as “Outcome” codes. However, it is important to be aware that not only the Interventional codes but also the Outcome codes included a variety of biophilic elements/parameters that were framed by previous researchers (Browning et al., 2014; S Kellert et al., 2011; Stephen Kellert & Calabrese, 2015): such as Curiosity, Refuge, or Prospect. Table 5-2 shows the classification of the codes. The classification was arranged based on the most frequent characteristic of the parameters, although there was no exact border between the Interventional and Outcome codes since an Interventional code can also exemplify an outcome of another intervention and vice versa. All parameters were deeply connected to each other. For example, furnishing design can use a material that creates a tactile experience that engenders a feeling of relaxation. Therefore Tactile Experience becomes an outcome of Material while it is also a feature that creates a sense of relaxation (Welcoming-Relaxing) as Interventional code (Figure 5-2).

Table 5-2: The Interventional and Outcome code groups.

Interventional Codes	Outcome Codes
Air	Curiosity
Architectural Form, Layout, Furnishing and Fittings	Perception by Gender
Bringing Outside to Inside	Perception by Personal past- Sense of Belonging
Colour	Refuge- Feeling Safe
Fire	Socialising
Greenery - Plants	View- Prospect
Light- Daylight	Welcoming - Relaxing
Material	
Multi-Sensory Experience	
- Auditory Experience	
- Olfactory Experience	
- Tactile Experience	
Seasonal Changes	
Spaciousness	
Thermal Comfort	
Water	

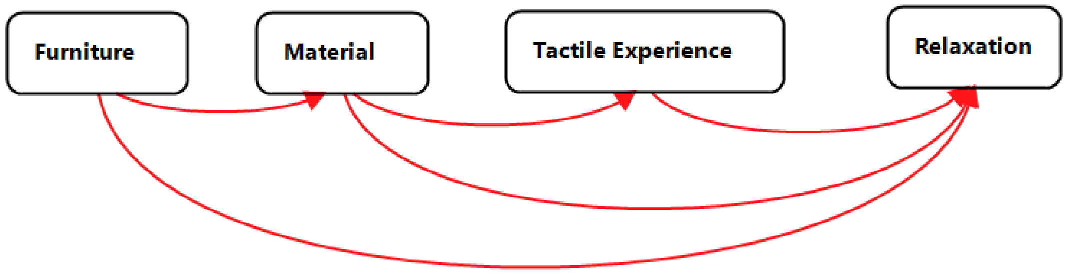


Figure 5-2: An example of Intervention-Outcome relation.

Figure 5-3 illustrates the coding system that was used in the meta-synthesis. Every response from interviewees quoted in the included studies was considered a base for coding. Every connotation for an outstanding architectural or biophilic element, which stands for a code, in one response was accepted as one reference to that code. Regardless of the number of references for a code in one response, all references to a code in one response were accepted as one since the informant was the same person. For example, in Figure 5-3, Response 1 was a base for coding. The green highlighted expressions were referring to the Greenery code, while the blue highlighted expression was a reference to the Auditory Experience code, and the yellow highlighted expressions referred to the Welcoming-Relaxing code. In this response, Auditory Experience and Greenery were Interventional codes because they caused a Welcoming-Relaxing feeling, which was an Outcome code here since it defined a resulting characteristic. Therefore, Response 1 comprised three References for three codes. In order to yield more reliable results, repetitions in quotations were ignored, and all expressions for a code were accepted as one Reference. For instance, the expressions “tranquillity”, “peace”, “such a pleasure to come here”, and “relaxing” referred to the Welcoming-Relaxing code, so all these four expressions were accepted as one Reference, while one expression “no noise of the city” was accepted as one Reference either for the Auditory Experience.

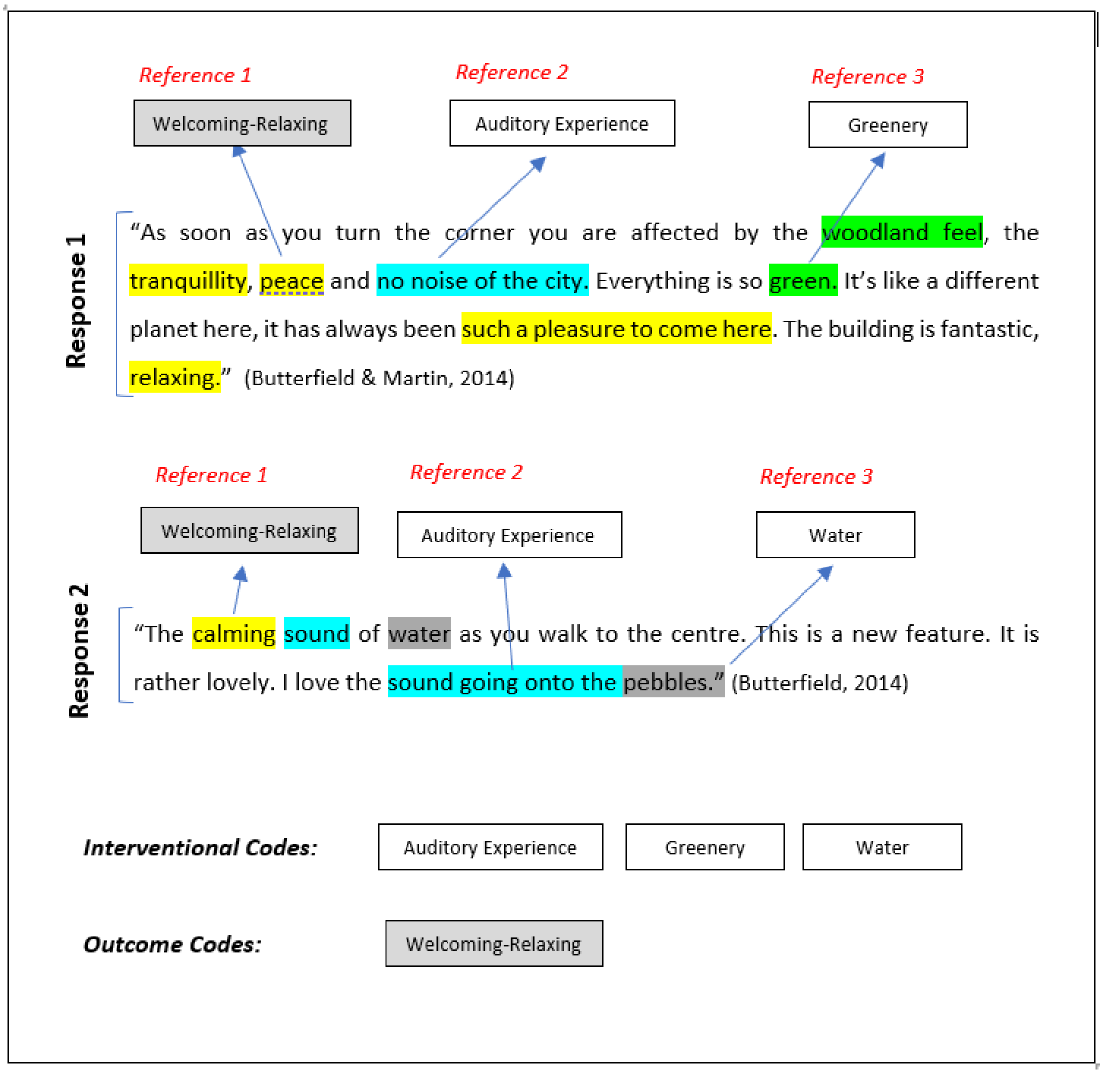


Figure 5-3: A sample coding method used in this review was the function of Responses, References and Codes are illustrated.

5.2.1. General Overview of the Analysed Documents

After deciding on the included documents, they were examined in detail by creating codes as explained in the previous section and illustrated in Table 5-2, for every detected architectural characteristic and their impacts regardless of whether they were biophilic features or not. Therefore, the results proved that Maggie's Centres' architecture had plenty of biophilic characteristics as was foreseen considering Maggie's Centre Architectural Brief (Maggie's Keswick Jencks Cancer Trust, 2015).

The 13 documents provided extensive insight into how Maggie's architecture works and the relationship between architectural elements which are substantively biophilic. In total 474 quotes related to biophilic parameters were compiled in 23 varieties of codes from these publications (Table 5-3). Comments about the data obtained from these publications are listed below, ranked in order of relevance to this research:

The majority of data, accounting for 143 references, was collected from a doctoral dissertation produced by Angela Butterfield, titled *‘Resilient Places? Healthcare Gardens and The Maggie’s Centres’*, completed at the University of The Arts London and Falmouth University in 2014. Although this study focused mainly on the gardens, interviewees had given plenty of data about the buildings themselves and their architectural connection with the gardens because people used the centre as a whole not only the gardens or the buildings. Thus, these interviews provided data on 20 different codes which represent the elements and impacts of architecture. However, it is important to emphasise that not all of the direct quotations from interviewees were used in the study; the parts that only focused on botany and other architectural irrelevant responses were ignored due to compiling confidential data for comparison with other parameters. For instance, the interview responses explained variations of plant names and their characteristics botanically.

Another crucial publication was the article ‘*Affecting care: Maggie's Centres and the orchestration of architectural atmospheres’*, published by Daryl Martin, Sarah Nettleton, and Christina Buse in 2019 in Social Science & Medicine journal. This study was carried out by interviewing 66 visitors, 22 staff members and 7 architects of Maggie's Centres across the UK and internationally. This source provided 81 references in 19 different codes.

‘Architects’ Approaches to Healing Environment in Designing a Maggie’s Cancer Caring Centre’ by Valerie Van der Linden, Margo Annemans, and Ann Heylighen was published in the Design Journal in 2016. This was a key source to obtaining data about the architects’ design approaches and observations of Maggie’s architecture, however, the architects’ opinions on the architectural brief and general design principles were mainly disregarded in this analysis, as the main goal was to collect data that have primary characteristics. Nonetheless, a total of 60 references were extracted in 14 different codes.

The subsequent publication was *‘A home from home: Maggie's West London excels at providing comfort and sanctuary’*, by Amanda Birch, Charles Jencks and Ivan Harbour, an architectural magazine article published in the Architects' Journal Vol. 239, Issue 15, in 2014. Although it was a paper providing an overview of Maggie's West London and its design, this publication included useful interviews with professionals such as an art therapist and a horticulturalist who were visiting the centre regularly, the architect Ivan Harbour, the centre’s head and staff, the property director, centre’s users and Charles Jenks as the client. Therefore, the paper delivered abundant valuable data, leading to 46 references, and 14 various codes.

The next study on the list was '*You'd want an energy from a building: User experience of healing environment in a Maggie's Cancer Caring Centre'*, by Valerie Van der Linden, Margo Annemans, and Ann Heylighen, from KU Leuven University. This paper was the published conference proceedings of the Third European Conference on Design4Health, which took place in Sheffield in 2015. This study aimed to show how architecture plays role in the user's wellbeing and reported the findings from a focus group interview with visitors and staff of the Maggie's Centre in Dundee. From this publication, 31 references in 10 different codes were obtained.

Another included conference paper from KU Leuven University was '*What Makes an Environment Healing? Users and Designer About the Maggie's Cancer Caring Centre London'* by Margo Annemans, Chantal Van Audenhove, Hilde Vermolen and Ann Heylighen, and published in Proceedings of the 8th International Design and Emotion Conference, London, September 2012. This paper gave insights from users and architects via interviews. A total of 25 references were collected from this source in 8 different codes.

Angie Butterfield from Falmouth University and Daryl Martin from the University of York presented '*The Silent Carers: Exploring the Role of Architecture and Gardens at the Maggie's Cancer Care Centres'* as a poster that was published in the Journal of Psycho-Oncology, Vol. 23, pp. 318-319, in October 2014. In this publication, they examined interview results in terms of both Maggie's buildings and Maggie's gardens. It contributed 18 references in 11 various codes.

'Social Impact: Maggie's Nottingham', based on Kelly Watson's post-occupancy evaluations was the next source of data. This was a chapter in the book *Building Knowledge: Pathways to Post Occupancy Evaluation*, created by an author team from the University of Reading, and published by the RIBA in 2016. The post-occupancy evaluation was carried out for six months through interviews, focus groups, surveys and observations. However, this massive research work was mainly summarised in this short chapter, thus, outcomes will be more rigorously taken into account in the thesis conclusion. 18 references in 10 different codes were yielded from this document.

'Designing emotion-centred Product Service Systems: The case of a cancer care facility' was the next more important publication for this analysis. This was a journal paper published by Patrick Keith Stacey and Bruce S. Tether in Design Studies journal in 2015. Although the paper provided a variety of data from interviews with architects, professionals and staff, only the data that referred to the observations about the buildings' atmosphere,

and experiences in the use of space were employed in the analysis. General information or usual experts' views on the design process were excluded. From this paper, 13 references in 6 different codes were included in the scrutiny.

Table 5-3: Included documents for analysis.

Title	Reference	Type	Number of Code Variants	Number of Coded Texts
Resilient Places? Healthcare Gardens And The Maggie's Centres	Butterfield, A. (2014)	Doctoral dissertation	21	143
Affecting care: Maggie's Centres and the orchestration of architectural atmospheres	Martin, D., Nettleton, S., & Buse, C. (2019)	Journal Article	19	81
A home from home	Birch, A., Jencks, C., Harbour, I. (2014)	Architectural Magazine	14	46
Architects' Approaches to Healing Environment in Designing a Maggie's Cancer Caring Centre	Van der Linden, V., Annemans, M., & Heylighen, A. (2016)	Journal Article	14	60
The Silent Carers: Exploring the Role of Architecture and Gardens at the Maggie's Cancer Care Centres	Butterfield, A., & Martin, D. (2014)	Conference Poster	11	18
Affective sanctuaries: understanding Maggie's as therapeutic landscapes	Butterfield, A., & Martin, D. (2016)	Journal Article	10	13
Social Impact: Maggie's Nottingham	Watson, K. (2016)	Book Chapter	10	18
"You'd want an energy from a building": User experience of healing environment in a Maggie's Cancer Caring Centre	Van der Linden, V., Annemans, M., & Heylighen, A. (2015)	Conference Proceeding	10	31
A man-friendly Maggie's	Mark, L. (2013)	Architectural Magazine	9	9
Empathic Service Systems: 'Designing' Emotion in a Cancer Care Service System	Stacey, P., Bascavusoglu-Moreau, E., & Tether, B. (2011)	Conference Proceeding	9	13
What Makes An Environment Healing? Users And Designer About The Maggie's Cancer Caring Centre London	Annemans, M., Van Audenhove, C., Vermolen, H., & Heylighen, A. (2012)	Conference Proceeding	8	25
Designing emotion-centred Product Service Systems: The case of a cancer care facility	Stacey, P. K., & Tether, B. S. (2015)	Journal Article	6	13
Maggie's Centre Barts, London: Steven Holl Architects L'Observatoire International'	Foges, C. (2018)	Architectural Magazine	3	4

Following, '*Empathic Service Systems: 'Designing' Emotion in a Cancer Care Service System'* by Patrick Stacey, Elif Bascavusoglu-Moreau and Bruce Tether was a published proceeding of the 44th Hawaii International Conference on System Sciences in 2011. The data was collected from Maggie's London, which was the first and only Maggie's Centre in England, regardless of the other five centres in Scotland, when this research was carried out (P. Stacey et al., 2011). This publication had more information on the expert opinion of architects, professionals and staff. However, some data were ignored due to repetition with the previous source, '*Designing emotion-centred Product Service Systems: The case of a cancer care facility',* as the two authors were the same in these two papers. Even so, 13 references in 9 codes are compiled from this document.

Subsequently comes '*A man-friendly Maggie's',* an architectural magazine article written by Laura Mark in 2013 in Architects' Journal, Vol. 238 Issue 12, p34-40. Even though it was not a long text, it gave a different point of view for looking into Maggie's architecture by examining spatial perception depending on gender. As mentioned in Chapter 2, some researchers claimed that nature was perceived differently by different genders as its effect was not the same on men and women(van den Berg & ter Heijne, 2005). The study focused on the Newcastle Maggie's Centre and included interviews with male visitors, staff and the architect. It delivered 9 references in 9 different codes.

Lastly, another architectural magazine article gave insight into lighting technologies used in Maggie's London to promote a sense of well-being in the centre. '*Maggie's Centre Barts, London: Steven Holl Architects L'Observatoire International*', written by Chris Foges, Lydia Lee, Mairi Beautyman and Kelly Beamon in Architectural Record in May 2018, Vol. 206, n.5. This article was deemed to be incorporated in this study although it mainly focused on lighting because it included quotations from the architect and engineer that strengthened and complemented the data obtained so far.

After having sorted all references from these 13 documents, the researcher analysed and synthesised all codes, particularly focusing on cycles and relations between the Interventional and the Outcome codes. Table 5-4 shows the number of references for each code for all documents. Although interrelation between all codes was analysed one by one regardless of whether they were classified in the Interventional or the Outcome group, the data reported in section 5.2.3 is based on Interventional codes and their outcomes, and interactions between Outcome codes were examined in section 5.2.4.

Table 5-4: Number of references in all documents for each code.

Identified Codes	Annemans et al., 2012	Birch et al. ,2014	Butterfield and Martin, 2014	Butterfield and Martin, 2016	Butterfield, 2014	Foges, 2018	Mark, 2013	Martin et al., 2019	Stacey and Tether, 2015	Stacey et al., 2011	Van der Linden et al, 2015	Van der Linden et al., 2016	Watson, 2016
Air	0	3	1	0	6	0	1	0	0	0	0	0	0
Architectural Form, Layout and Furnishing	7	6	0	1	7	0	1	10	4	2	7	13	4
Bringing Outside to Inside	0	0	1	0	8	0	0	1	0	2	1	0	2
Colour	3	0	0	0	5	0	0	8	0	0	0	0	1
Curiosity	0	0	0	0	1	0	0	2	0	0	3	4	0
Fire	0	3	0	0	0	0	0	0	0	0	0	1	0
Greenery- Plants	1	3	3	1	20	0	1	1	2	1	0	4	0
Light- Daylight	1	7	2	1	9	2	1	6	0	2	2	3	2
Material	0	0	2	0	2	0	1	11	0	0	1	2	2
Multi-Sensory Environment	0	3	1	1	10	0	0	7	1	0	0	2	0
• **Auditory Experience**	0	2	0	1	6	0	0	3	0	0	0	1	0
• **Olfactory Experience**	0	1	1	1	2	0	0	2	1	0	0	0	0
• **Tactile Experience**	0	0	0	1	1	0	0	3	0	0	0	0	0
Perception by Gender	0	0	1	0	0	0	1	1	0	0	0	0	0
Personal Past- Sense of Belonging	0	4	1	0	10	0	1	2	0	1	1	5	1
Refuge- Feeling Safe	0	1	0	0	10	1	1	7	0	0	3	1	0
Seasonal changes	0	0	0	0	8	0	0	0	0	0	0	0	0
Socialising	4	1	1	0	3	0	0	1	2	2	5	1	2
Spaciousness	1	0	0	0	3	0	0	1	0	1	3	4	1
Thermal Comfort	0	4	0	0	3	0	0	1	0	0	0	0	0
View- Prospect	1	2	0	1	7	0	1	2	0	1	0	6	2
Water	0	0	0	1	5	0	0	0	0	0	0	0	0
Welcoming - Relaxing	7	6	4	2	17	1	0	11	3	1	5	13	1

5.2.2. Analysis of the Codes and their Interrelations

After sorting all comments from these documents, the data was analysed and all codes were synthesised, particularly focusing on cycles and relations between the Interventional and the Outcome codes. Table 5-4 shows the number of comments for each code for all documents. The interrelation between all codes was analysed one by one regardless of whether they were classed as Interventional or Outcome codes. Based on this classification, the Maggie's Centres architecture can be examined under two main subjects: "Architectural

Design Parameters” (Interventional codes) and “Experiential Wellbeing and Psychological Support Parameters” (Outcomes codes). It is important to notice that the Outcome codes also included mentions of several biophilic parameters, as identified in established biophilic design frameworks (W. Browning et al., 2014; S. Kellert et al., 2011; S. Kellert & Calabrese, 2015).

The list of specific parameters identified in these studies is: Light-Daylight, Greenery-Plants, Natural Colour, Water, Seasonal Changes, Fire, Sensory Stimuli, Spaciousness, Inside-Outside Connection, View, Prospect, Refuge, Personal Past-Sense of Belonging (Cultural Connection to Place, Affection and Attachment, Historic Connection to Place, Integration of Culture and Ecology), Feeling Safe and Curiosity-Enticement. Although Natural Material is a biophilic parameter, not all material references were natural and only in some cases the design of Thermal Comfort was biophilic, hence, these codes were considered partly biophilic (see Figure 5-4). Welcoming-Relaxing is not an established biophilic parameter, but was found as an ‘umbrella’ code intrinsically connected to some biophilic parameters, namely: Mastery-Control, Affection-Attachment, Attraction-Beauty, Information-Cognition, Reverence-Spirituality, Spirit of Place. Therefore, the identified set of “Biophilic Design Parameters” intersects both subjects. During this classification, it was noticed that some codes present some ambiguity, as they could be interpreted as being partly Interventional and partly Outcome, and were discussed using a gradation system with three levels in each subject area. Figure 5-4 illustrates this classification of the codes.

As an overarching code, Architectural Form, Layout, and Furnishing was the most prominent Interventional code to support a healing environment. It is not an established Biophilic Design parameter, but it was included in this analysis since it was deeply connected to aspects of biophilic design that were applied to Maggie’s architecture: Personal Past-Sense of Belonging, Refuge- Feeling Safe, Curiosity, Material, Colour, Light-Daylight, View-Prospect, Bringing the Outside to the Inside, Spaciousness, Air, Greenery-Plants, Thermal Comfort, and Fire. As it contained or affected other Architectural Design Parameters it was categorised as a Level 1 Interventional code (Figure 5-4).

The Level 2 of Interventional codes included Light-Daylight, Greenery-Plants, Colour, Water, Seasonal Changes, Fire and Material (Figure 5-4). These codes formed part of the Architectural Form, Layout, and Furnishing code. Based on the analysis, the Level 3 Interventional codes were Sensory Experiences, Spaciousness, Bringing the Outside to the Inside, and Thermal Comfort. These elements did not exist by themselves and all of them were affected by the Levels 1 and 2 Interventional codes, but they were placed within Interventional codes because they impacted and contributed to the Outcome codes (Experiential Wellbeing and Psychological Support Parameters). All the Level 2 and 3 Interventional codes were also biophilic design elements, however, the Material and Thermal Comfort codes also represented non-biophilic elements in their category.

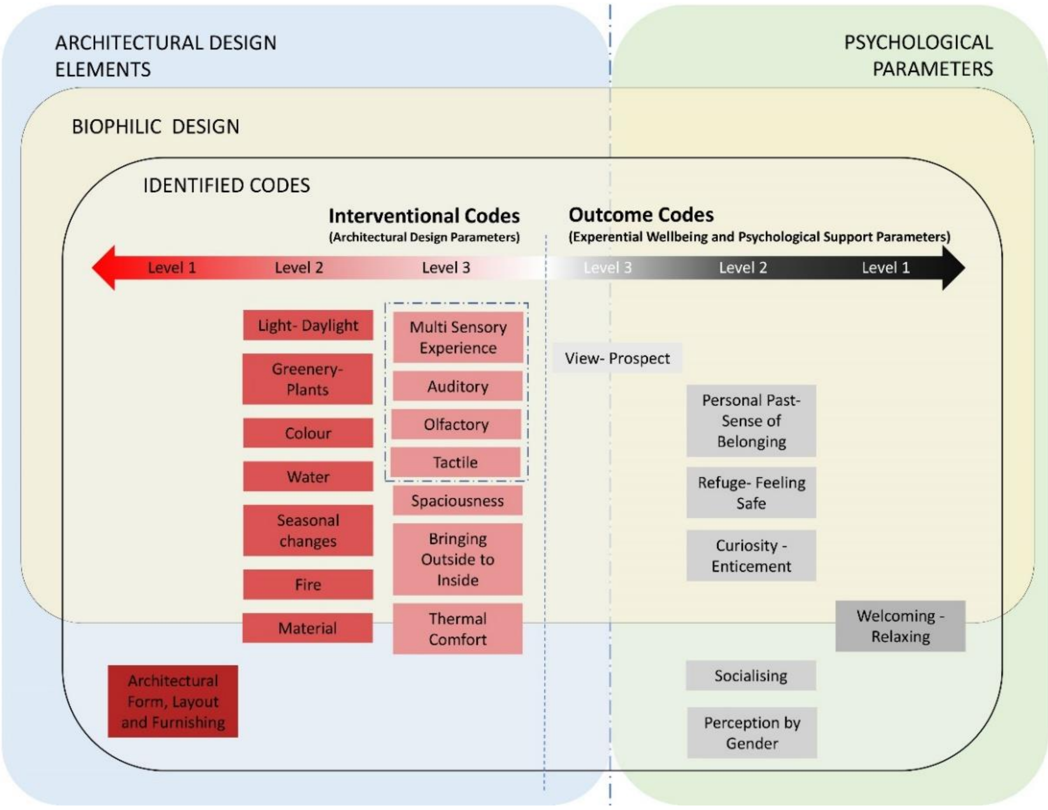


Figure 5-4: Classification of the codes.

The meta-synthesis proved that the Welcoming-Relaxing code was the most prominent Outcome code, including some of the fundamental goals as claimed in both biophilic design and Maggie’s architectural brief, such as being “comfortable”, “stress reductive”, “relaxing”, “calming”, “friendly” and “welcoming”, thus it was categorised as a Level 1 Outcome code (Figure 5-4). The Level 2 Outcome codes included effects of Interventional codes, but these codes could also impact each other as well as the Welcoming-Relaxing code. Three of the second-level Outcome codes represented biophilic design parameters (Personal Past-Sense of Belonging, Refuge-Feeling Safe, and Curiosity- Enticement); whereas the other two, Socialising and Perception by Gender, were not Biophilic Design parameters but they had value in Maggie’s Centres’ environment. The only Outcome code classified in Level 3 was View-Prospect. These two different Biophilic Design parameters were examined in the same code since they are intrinsically connected, and they were usually referred to together by interviewees. For example, a cancer patient in Study 1 defined the view of Maggie's Dundee as "I like the fact that you can see lots of things – the road. It is tranquil, especially with the grasses rustling. You can still see life and people and things going on." Hence, they were categorised together under the Outcome codes, but "View" as an Architectural Design Parameter, had a stronger intervention character, while "Prospect" was more clearly its Outcome.

As explained above the codes were interconnected and some of them contributed and triggered each other. These interconnections are depicted in a mind map (Figure 5-5). It can be clearly seen that the Architectural Form, Layout and Furnishing code had an impact on almost all codes, particularly on other Interventional codes. Likewise, almost all codes contributed to the Welcoming Relaxing code. Other codes in between, mainly biophilic design parameters, generated new Outcomes or strengthened this connection in various interactions. This mind map only indicates the strongest connections revealed through the meta-synthesis analysis for higher clarity. A detailed discussion of each code is exposed in the next section, presenting some of the users' specific comments interpreted in our analysis. This section is structured to sequentially present each of the Interventional codes and their corresponding Outcomes.

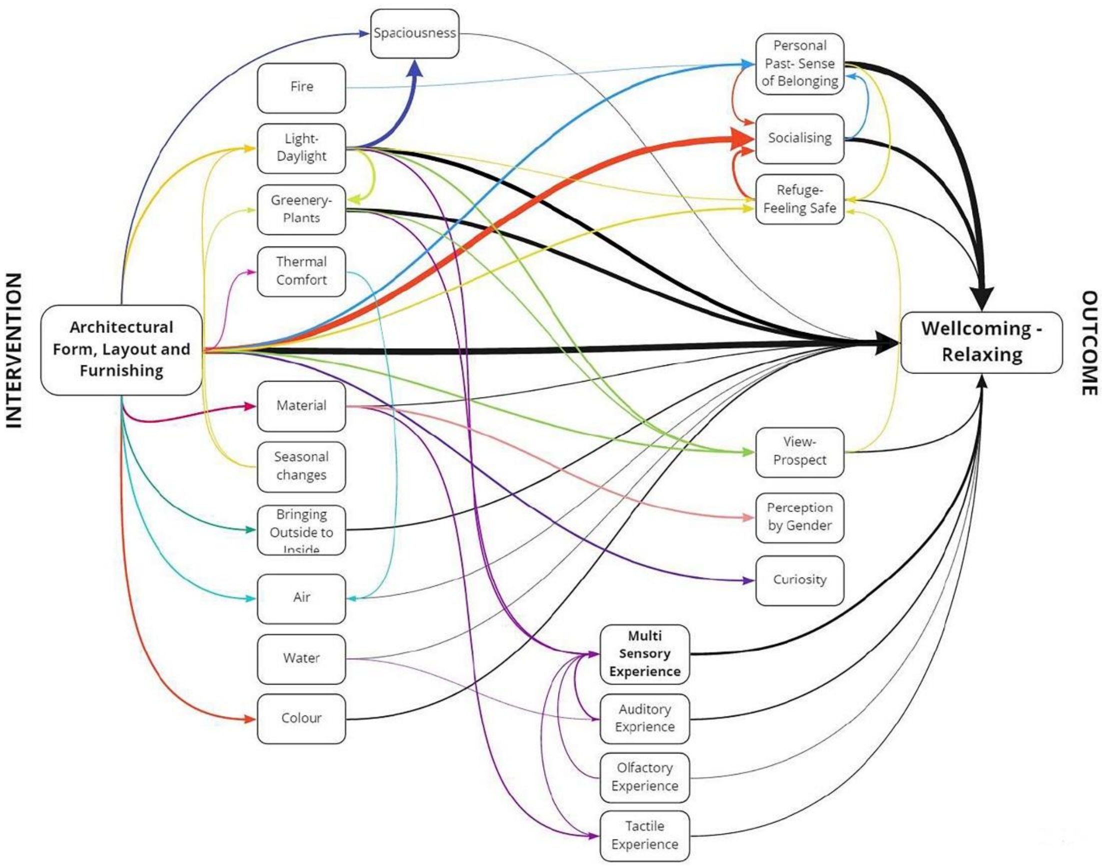


Figure 5-5: Mind map of the codes (Thickness of arrows illustrates the importance of connection based on this study. All arrows targeting the same code are represented with the same colour).

5.2.3. Interventional Codes and Their Outcomes

This section examines meta-synthesis analysis with a particular focus on Interventional codes and their relationship with each other, and also defines the Outcomes of each Intervention.

5.2.3.1. Architectural Form, Layout and Furnishing

People referred to architectural forms, design of layout, furniture and fittings in 62 responses. Although it was a substantial code and had connections with 18 of the codes, the analysis shown in Figure 5-15 confirmed that Socialising and Welcoming-Relaxing were the most significant Outcome codes linked to this code.

In terms of being welcoming and feeling at home, the most mentioned characteristic was the entrance of the buildings. People found Maggie's Centres as non-clinical and quite welcoming since there was no reception desk, they just felt relax to enter the buildings without being intimidated by a front desk where they might feel obliged to give explanations (Figure 5-6).

The feeling free also triggered being more social; the absence of a reception desk was frequently indicated in the interviews. Usually, the notion of a reception desk made people think of a reason why they needed to visit the place. On the other hand, people would create a relationship with the receptionist staff and would avoid interacting with other people, the situation was explained by a professional staff (Study 11, p.7):

> *Not having a reception desk means that you can see somebody, that you already have a personal relationship ready. Somebody comes up to you to see how you do and you can make a cup of tea and you can already start interacting. If you come in the front door then you have the main table where people sit around the corners and you can have a conversation.*

The reassuring small entrances were considered as a relaxing place that helped people to prepare themselves before entering the centre, and it slowed people down with a feeling of being at home (Figure 5-7) (Studies 2, 3, 8, 11). Besides, entering the centre was considered a meaningful turning point by patients, since entering the centre means accepting their cancer and starting to fight it (Study 4). Therefore, the architects tried to calm down people by distinguishing the entrance with their own design approaches. The entrance of Maggie's Dundee (Figure 5-7b) was appreciated for its unconventional geometrical form and its spaciousness, which also aroused curiosity to explore (Study 4). In contrast, the visitors at the centres in London, Edinburgh and Cheltenham criticised the entrances which were not clearly visible, a visitor emphasised that she struggled in her first visit when she freshly figured out her illness and was in a state of shock (Figure 5-8) (Study 1).

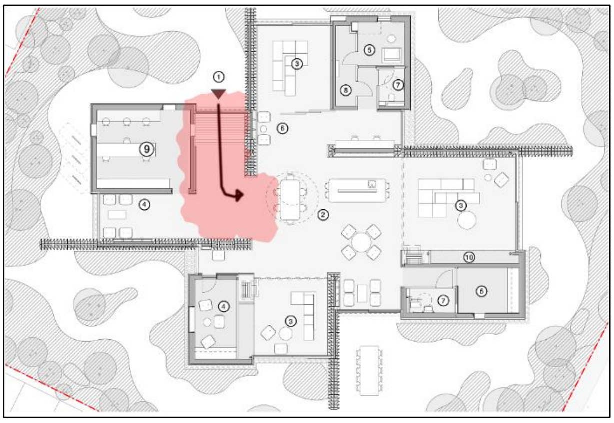


Figure 5-6: Entrance on Maggie's Southampton Plan.

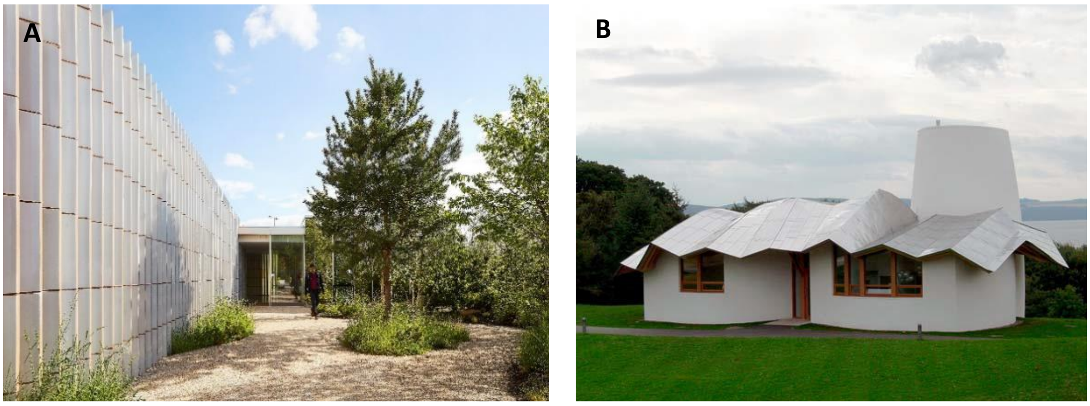


Figure 5-7: a) Maggie's Southampton Entrance, b) Maggie's Dundee Entrance.

Figure 5-8: a) Maggie's Edinburgh, b) Maggie's Cheltenham Entrance.

Attracting people to the centres by curiosity is mostly mentioned along with the architectural form of design. The unconventional striking architectural forms or non-traditional shapes and visual eccentricity were usually featured by interviewees since these forms aroused curiosity and encouraged people to step in (Figure 5-9) (Studies 1, 2, 4, 9, 12). Some responses confirmed that these centres let people feel safe in their homely small-scaled forms (Studies 1, 2, 4). A male visitor likened Maggie's Dundee to an old fisherman-type cottage, so this familiar feature made him feel welcomed and relaxed while in the building (Figure 5-7b) (Study 1).

Although unfamiliar forms triggered curiosity and attracted people to the centres, this could also be seen as risky in the long term in terms of a sense of belonging. Because they do not get used to such forms in their usual life that were exaggerated and unfamiliar for some of the informants. Thus, a visitor did not appreciate irregularly shaped centres and interpreted them as the architect's flight of fancy (Study 2). However, according to the responses of users, the architects handled this risk substantively by using relaxing natural elements and homely designed layouts which also aroused a sense of belonging in a different way. Also, the sharp and unconventional striking architectural forms were used by some designers to attract male visitors more (Study 9).

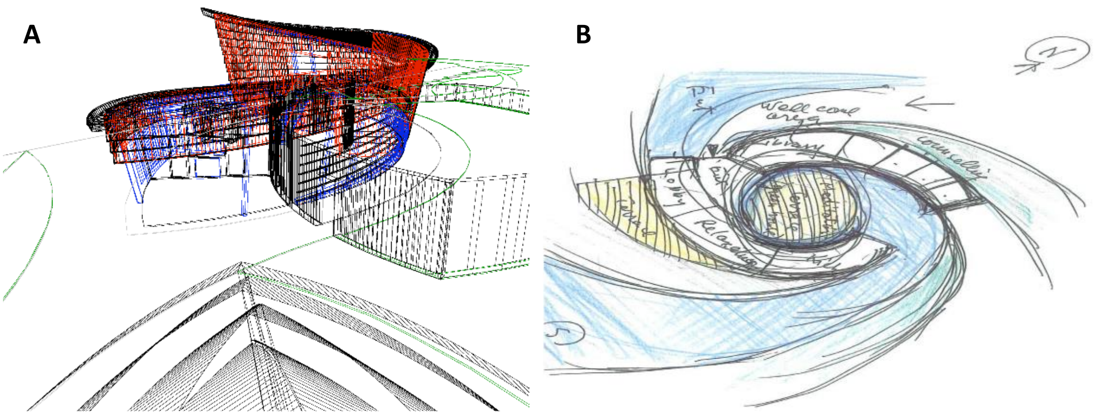


Figure 5-9: a) Maggie's Highlands architectural form design, b) Kurokawa's sketch of Maggie's South West Wales.

People frequently praised the layouts of centres, mostly in association with the provision of a relaxing, safe place, due to the very distinctive plans so different from clinical settings. The open space concept has been commonly adopted by the designers of these centres because this spatial organisation allows the users to socialise and supports the non-clinical feeling, as the usual layout in hospitals and other health centres is based on highly compartmented spaces with a high proportion of corridors (Figure 5-10). One could think that open plans bring an issue with privacy provision, however, despite visitors being a vulnerable population, it was emphasised in a focus group that "the open-plan configuration does not threaten privacy as long as it allows withdrawal" (Study 4). To address this issue, some designers claimed that they created enclosable spaces to provide privacy rather than fully closed cellular rooms (Ibid.). Private spaces and individual therapy rooms were usually set apart from busy communal areas and situated with a view to the outside (Study 3). The balance between socialising and privacy for the visitors was appreciated (Study 8; p.7): “When you are used to the Centre and used to using it, you understand that you can do private without being isolated.”

Figure 5-10: Maggie’s Oldham open plan layout.

In Maggie’s West London, privacy was supplied by designing with reverberate (transmit) acoustic in the communal areas where the visitors liked talking without being overheard (Study 10). The open plan configuration was appreciated by visitors because they liked the feeling of being together and because it promotes social activity, which was exactly what the open-plan building offers, as people did not get to disappear easily around a corner. This layout allows to have glimpses of the communal activities without hesitation feeling intimidated or obliged to participate, and It also grants visual connection with the spaces upstairs, with half-landings providing a feeling of control of space and awareness of what activities were being held (Figure 5-11a) (Studies 3, 4, 8). A visitor clearly stated that she felt relaxed while socialising in one of Maggie’s Centres' open spaces; whereas she used to feel quite depressed and wanted to leave as soon as possible when she had been visiting another cancer centre (Study 11). Open spaces also enabled caregivers to keep an eye on visitors without attracting their attention and to deliver therapy easier. Nevertheless, this transparency still caused some privacy problems from the staff point of view (Studies 4, 8), which was clearly stated by a staff member (Study 1; p.321):

> *It is an open and fluid building. At a functional level it is fluid and enmeshed. There is a mutual sense of belonging. But I find it challenging as a worker. I have no personal space. Visitors use the space as their own – that is a wonderful thing but I think the openness and perception of privacy here is detrimental to staff.*

One of the most important attributes of the architectural planning of Maggie's Centres was their capacity to support spontaneous socialising. For example, the planning of Maggie's Edinburgh with its visual connection between the first floor and ground floor (Figure 5-11b) was associated with the idea of visiting a house where they were welcomed by others with tea and could interact next to a fireplace (Study 3). Another visitor summarised the impact of Maggie's Centres' interacting architecture in the study (Study 8; p.5): "It's very much designed so you can't avoid meeting people. Can you? You can't come here and disappear into a room in the corner somewhere."

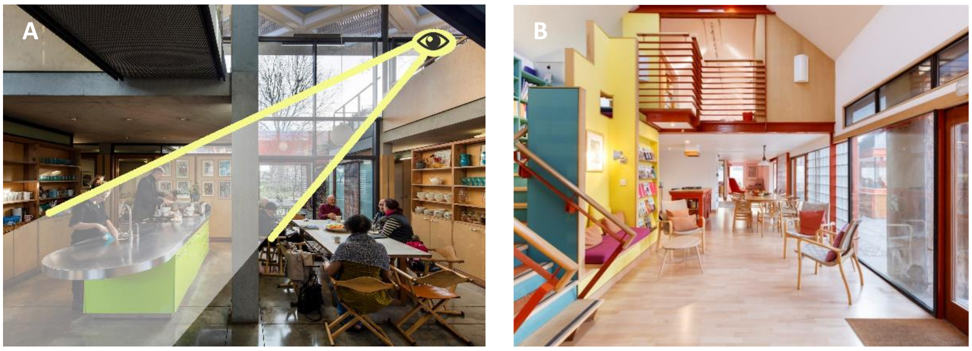


Figure 5-11: a) Maggie's London, visual contact between floors, b) Maggie's Edinburgh half-landings.

Apart from the layout, furniture and fittings had also a crucial role in making people social and relaxed. The kitchen table was one of the most distinguishable characteristics of Maggie's Centres from the conventional healthcare settings. After having entered the centre through the 'welcoming' entrance, people came and sat around the table and made tea for themselves while getting used to the atmosphere, and this friendly ritual encouraged them to use the centre efficiently, and this friendly ritual encouraged them to talk and greet the other visitors and staff (Figure 5-12) (Studies 3, 7, 8, 11). Having a kitchen table instead of desks maximised the interaction (Study 7). The interviewees emphasised the meaning of the kitchen table: "Ooh that is our table. That is our family table." Or "That is our anchor that is the family anchor." (Study 11).

The kitchen table and the atmosphere of the kitchen had the power for the feeling of safety and refuge that calmed down many angry and worried patients immediately and the place was safe enough to socialise with their minds at peace (Study 3). People emphasised how this congregation around a table allowed them to interact with people and had a homely feeling (Studies 3, 7, 8, 11). The head of Maggie’s West London explained one of her observations about the kitchen atmosphere in this response (Study 3; p.5):

A woman came in recently really angry, and she reached the kitchen and immediately calmed down. Later she said she found it hard to be angry because the building wasn't what she expected. Children instinctively pick up on the feelings of calmness and friendliness here. Some have called the centre, the 'chillout building'. Aspects of the architecture are designed to produce a feeling of containment, and every room has a sense of contained space, so people feel protected.

Figure 5-12: a) Maggie’s Manchester kitchen, b) Maggie’s Oldham kitchen.

Design related to big windows and the use of curved walls reflected the quality of the balance between the feelings of prospect and refuge (Studies 4, 8). Another architectural element that encouraged prospect and refuge by allowing people to see outside without being seen was the window screens in Maggie’s West London, shown in Figure 5-13 (Study 1). A member of staff in Maggie’s West London stated her observations regarding the refuge and prospect characteristics of the centre (p. 212):

It is that thing of sharing. Of being open. Not being possessive. Being open about cancer. I feel there is, within the centre, also an openness, although it is contained and closed too. People can see, we can see out without being totally exposed. There are privacy and protection.

The huge walls around the garden were also indicated as a sign of feeling protected and escaping from the horror of the hospital environment (Study 1).

Figure 5-13: a) The screen in Maggie's West London, b) Maggie’s West London.

Another outstanding fitting characteristic, there were no signs in the centres, which helped to enhance the non-clinical homely feeling. However, this helped the new visitors to start interacting with others by forcing them to ask questions. A professional member of staff stressed their aim (Study 12; p.96): "There are no signs to the toilet because actually asking where the toilet becomes an opportunity for communication, it signals a simpler environment, more informal. we wanted our building to encourage human interaction."

The same procedure was suited for manually operable windows for which people asked others whether they felt cold or warm. Operable windows allowed people to regulate thermal comfort and air quality and also helped to improve relaxing and homely feelings by giving an option to adjust the environment according to the users' comfort (Figure 5-14a) (Studies 8, 12).

Sliding doors also had an unpredictable impact, as tacit a sign of privacy in the centre. When the visitors saw a door closed, they knew the room was occupied, thus, people did not need to knock on the door (Figure 5-14b). They did not have to ponder as with a normal door whether they were meant to knock or not. This use of sliding doors allowed people to feel and move comfortably within the centre because they did not need to hesitate or check the rooms before entering (Studies 3, 4, 10, 11). The use of sliding doors was explained by a member of staff (Study 10; p.6):

> *We've got private spaces where you can shut the door and you can have a group or a consultation in complete privacy and we've got a language which has developed, I think, which is the sliding door type thing, where when a room's not in use it's just open. You don't have to have In Use, it's just a language that people get familiar with is that when the door is open you can wander in and use the sofa.*

Figure 5-14: a) Maggie's Southampton furnished room with operable windows, b) Maggie's West London sliding door.

Throughout all the studies, quality and choice of furniture and fittings were also stated by visitors. Some of them told that the quality and choice of furniture in the buildings made them feel special, warm and comfortable (Figure 5-14) (Studies 2, 7). However, a visitor also mentioned some drawbacks about them, such as some uncomfortable chairs and poorly working toilet taps (Study 3).

Figure 5-15: References to the Architectural Form, Layout, Furnishing and Fittings, and interrelation with the other codes referred together.

5.2.3.2. Light- Daylight

There was a limitation in this study in relation to daylight, as all responses about the impact of light were not included in publications by authors because daylight was mentioned frequently with similar outcomes, thus, authors did not want to reiterate similar responses in their studies. This presents an obvious obstacle for this study to analyse possible nuances in the different comments on the perception of daylight in connection with wellbeing. However, Study 12 stated that all those interviewed pointed out daylight as a very important way of improving their emotional well-being. Here, it was understood that natural light was more important than it was in their analyses, and should have more references than those documented in these 13 studies. Also, in Study 4, the focus group showed that ‘light’ and ‘spaciousness’ were accepted as architectural contributors to the healing experience by providing relaxation and stimulation, and both made people feel good physically. As stated in the previous section, it was expected that natural light would be a key factor in therapeutic environments, along with plants, to how the building feels (Study 3).

Daylight was actually an important criterion in Maggie’s Architectural Brief (Maggie’s Keswick Jencks Cancer Trust, 2015), and it is a clear common factor that the centres’ architects wanted to expose the inside to natural light as much as possible. Although the fully glazed facades or big windows were mainly used for bringing daylight in (Figure 5-16a,b,c) (Studies 2, 3, 4, 5, 7), some other daylight sources were mentioned in the interviews such as clerestories, the roof fenestrations fitted with selective shading devices, roof openings (Study 3), atria, courtyards, glass-walled porches (Study 1), small openings and skylights (Figure 5-16) (Study 4). The gardens and balconies, however, were the places where users frequently enjoyed direct sunlight (Studies 1, 4, 5).

Rather than stating outcomes of the daylight, many people admired, loved and indicated the presence of daylight itself as a sign of high quality and healing architecture, and emphasised that they just needed that light for the healing process (Studies 1, 2, 3, 4, 5, 8, 9, 10, 11). Abundant daylight and the provision of bright space contributed to the non-institutional feeling, and it was a basic element to create a comfortable sanctuary away from the stressful clinical hospital environment (Study 3). The presence of daylight aroused a homely feeling by relaxing patients. Also, some of the interviewees, particularly foreign people, connected sunlight together with some other elements to remind their hometowns and trigger a sense of belonging to the centre (Studies 1, 3). A patient explicitly claimed that the natural light and air in the centre took him away from cancer and helped him in the healing process (Study 6).

The daylight prompted pleasant thoughts in the visitors; the welcoming and relaxing effect of natural light place was also indicated (Study 1). Together with the plants, it also made the centres alive and provoked a motivation for living. The gardens, balconies, winter gardens, and sunny corners, in short places where there was sunlight exposure, became places to have positive, happy, refreshing feelings for the cancer patients, particularly whenever they were upset, stressed or wanted to be private but not isolated (Ibid.). Receiving the sunlight also helped to be aware of the time of day and seasonal changes which made some of the staff feel better and less stressed compared to working in their previous jobs in closed, mainly artificially illuminated wards and other healthcare environments (Ibid.).

The lighting design evoked spirituality as well, a cancer patient expressed that the light in the centre had a similar feeling he had at a church that he recently visited (Study 2). An architect clearly stated taking the daylight inside while planning the design was far more important than colours and wallpapers, which were commonly a consideration for designers of healthcare settings (Ibid.). In short, the daylight exposure in the centre promoted important characteristics of a healing environment such as peace, calm and stress reduction (Study 8). The warmness and softness of light were also associated with the feeling of safety (Study 13), privacy and protection (Study 1).

Daylight was required by the designers as a tool for creating a distinction from usual healthcare facilities, and many of the interviewees pointed out their impression of the light and how they did not expect this light and the bright environment in a hospital (Studies 1, 3, 5). The designers were also rigorous about the functions of rooms and their lighting requirements. The art therapy classes required bright light, while softer and dimmer light was used in relaxation classes (Study 3). On the other hand, the staff used artificial light along with the natural one to make people relaxed, it was expressed that they left overhead and task lighting on even if there was sufficient daylight because patients with anxiety felt more comfortable (Study 3). The warm, soft and bright lighting made the people feel welcome regardless of the time of day (Study 13). Figure 5-17 illustrates that the Light-Daylight code had a relation with 21 other codes in this review; this important code had the strongest connections with the Spaciousness, Greenery-Plants, Welcoming-Relaxing, and View-Prospect codes.

Figure 5-16: Natural lighting examples from Maggie's Centres a) Maggie's Southampton, b) Maggie's Oldham, c) Maggie's South West Wales, d) Maggie's Gartnavel, e) Maggie's Manchester, f) Maggie's Southampton, g) Maggie's South West Wales, h) Maggie's Gartnavel, i) Maggies's Cardiff.

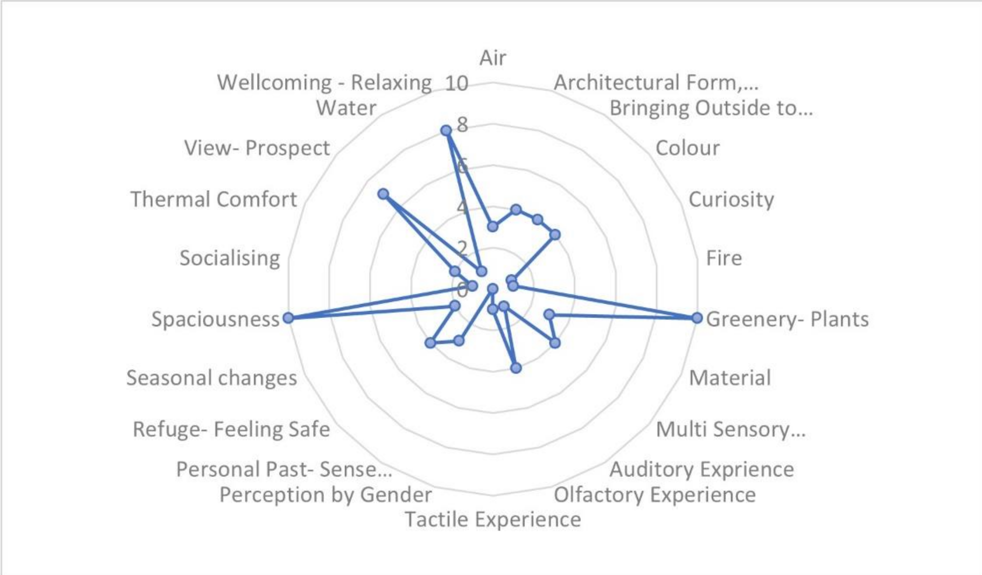


Figure 5-17: References to Light-Daylight, and interrelation with the other codes referred together.

5.2.3.3. Greenery- Plants

A healing environment includes the presence of plants and greenery (Study 11) since greenery has always been the element that is more strongly associated with nature in people's minds, compared to the other elements. Greenery was included in the centres in a variety of ways and purposes. Although green elements and their contexts in the centres were mentioned in a variety of ways (as indoor plants, indoor gardens, balconies, roof gardens, potted plants, vibrant cut flowers etc.), the most stated context in which greenery was appreciated was the centres' gardens themselves (Figure 5-18).

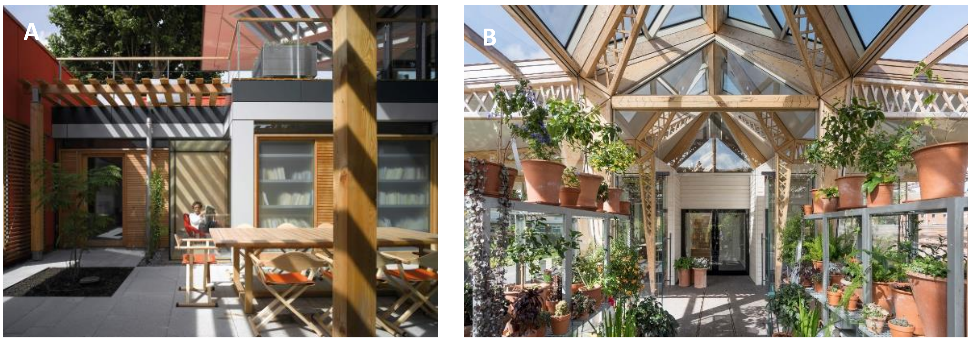


Figure 5-18: a) Indoor garden Maggie's West London, b) Indoor garden Maggie's Manchester.

Almost all of the interviewees stated that plants in Maggie's Centres affected their health, wellbeing and feelings in a positive way. Plants and vegetation, in general, were perceived as 'healing' (Study 11), 'admirable', 'fantastic', 'feels like home' (Study 3), ‘peaceful’, ‘relaxing’, ‘protected space’, ‘feeling safe’ (Study 5), ‘alive and changing’, ‘sense of welcome’, ‘barrier with the outside world’, ‘buffer zone’, ‘threshold’, ‘place of relaxation’, or ‘calming’ (Studies 1, 4). The garden and its plants slowed people down and relaxed them when they approached the buildings and encouraged them to enter (Study 1). Plants created an atmosphere that distinguished Maggie’s Centres from most healthcare environments, where a male interviewee defined these other environments ‘as no place to linger, no place to revisit, no sense of welcome’. However, the same person said (Study 1; p.201):

> *Maggie’s Centres’ entrances begin the process of arriving that engenders pleasant thoughts and feelings where colours and greenery are light and airy. Viewing gardens from inside pleases the viewer and connects them with a wide empathic space.*

It was widely accepted by the interviewees that the gardens and greenery had a powerful relaxing impact, even in a very short distance walk in the gardens before arriving at the entrance made them feel calm and relaxed. Also, pots of beautiful flowers were put at the entrance by staff to create a feeling of a threshold. The variety of plants created a sensory richness and encouraged people to enter and discover the centres to some extent, also, various plants reflected the seasonal changes and transformed the centres' atmosphere every day (Study 1).

A visitor said that there were no grim corners thanks to the plants, while some of the participants saw the plants as the most important stress-dropper, and one of them told that she would be sick without these plants. Watching living plants was perceived as refreshing and motivating while the people here were trying to survive (Study 1). Although the plants and gardens were associated with the feelings of ‘alive’ and ‘joyful’, some people with cancer complained about dying plants and leaves which remind them of their mortality (Study 10). The spiritual effect of greenery was explicitly expressed by a cancer patient (Study 1; p.274):

> *There is something about that here. The greenery – ‘it all fits’. It lifts – it’s not overwhelming, it’s calming. I can’t imagine it without the greenery. Look at that majestic tree. Look how it’s moving. The greenery is the closest I get to God – it’s not the people, its nature, cycles, birds, purpose, never dead.*

Another outstanding impact of the gardens and greenery was the barrier and buffer effect between the centres, and hustle and bustle of the outside environment and the nearby hospitals (Figure *5-19*) (Studies 1, 9, 12). Moreover, these barriers created a refuge where people felt safe, protected, and private (Studies 1, 5, 9). A visitor explained how she felt about the garden and plants (Study 5; p.1):

> *As soon as you turn the corner you are affected by the woodland feel, the tranquillity, peace and no noise of the city. Everything is so green. It's like a different planet here, it has always been such a pleasure to come here. The building is fantastic, relaxing.*

Figure 5-19: Buffer zones surrounding Maggie's Dundee.

The greenery was one of the most crucial elements that triggered users' feelings. The designer stated "The plethora of natural light and planting is key to how the building feels" in Study 3. Along with the visual impact of the greenery and plants, it was extracted from the responses that they elicited other sensory perceptions in people: the smell of scented plants and blossoms (Studies 3, 5), the tactile texture of the tree trunks and sitting on the grass, hearing rustling leaves and rain's pattern on the leaves, hearing the singing of birds that perched on the trees, or the taste of edible plants and fruits (Study 1, 12).

Although Greenery-Plants was an extensive code presenting a relationship with 20 other codes, the strongest connections were found with the codes of Welcoming-Relaxing and Light-Daylight (Figure 5-20).

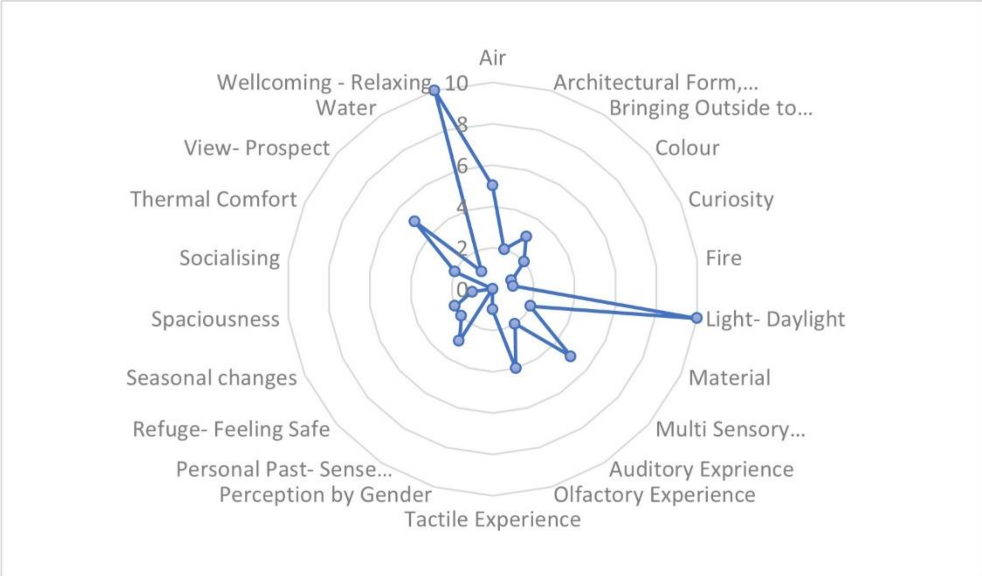


Figure 5-20: References to Greenery-Plants, and interrelation with the other codes referred together.

5.2.3.4. Sensory Experiences

These codes focused on the main sensual perceptions of the interviewees in their experience of the centres, however, the sense of sight was not included in these codes since comments related to visual perception were highly detailed in the other codes. The interviewees' responses were classified in the code of the multi-sensory experience and its three sub-codes: the olfactory experience, the tactile experience, and the auditory experience. According to the collective analysis of all four sensual codes (Figure 5-21), the sensory experience in Maggie’s Centres was substantively framed around and associated with one outcome code, Welcoming-Relaxing, and three interventional codes: Greenery-Plants, Materials, and Light-Daylight. in addition to this, Refuge-Feeling Safe, Personal Past-Sense of Belonging, Water, and Thermal Comfort were other outstanding codes for sensory experiences.

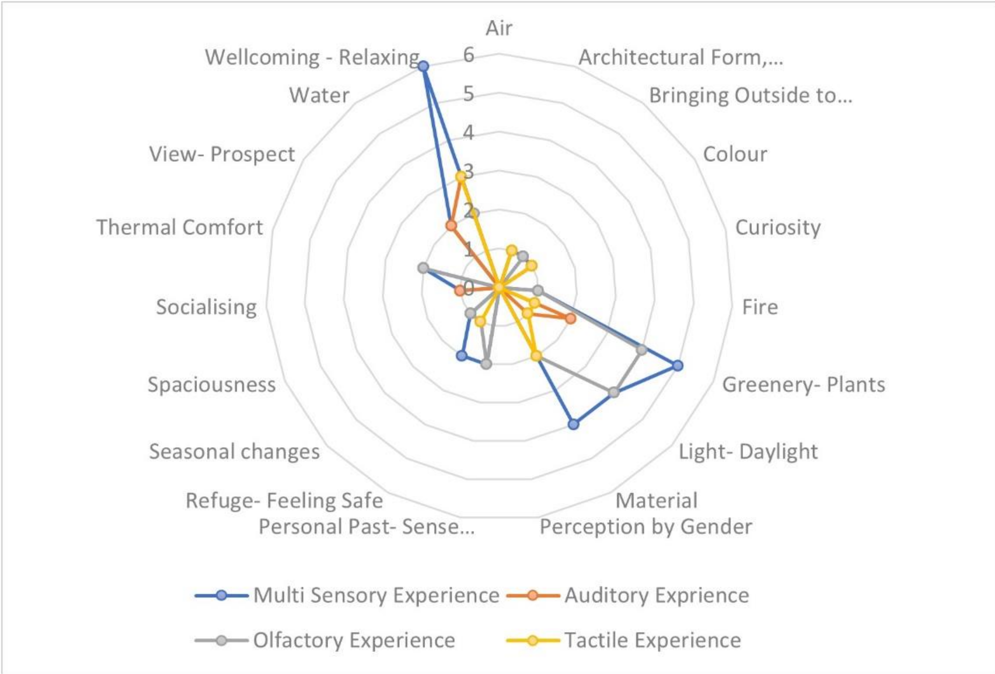


Figure 5-21: References to all sensory experiences, and interrelation with the other codes referred together.

a. Olfactory Experience: Sense of Smell

In terms of the olfactory experience of Maggie's Centres, the gardens and green spaces were mentioned the most by far (Figure 5-22). People admired the fragrance of bloom, flowers, grass and plants, and the smell of soil when it rained (Studies 1, 3, 5, 12). It was pointed out that the smell of the garden was also coming into the centre with the breeze, which created a strong connection between the outside and the inside (Study 1). Just after defining the smells, the users frequently associated the space with a homely feeling, feeling relaxed and feeling safe (Studies 1, 3, 5, 12). The smells of plants had a calming down and meditating impact, particularly on the cancer patients who were feeling vulnerable and experiencing a lack of capacity to feel sensations due to their treatments. A cancer patient pointed to this situation (Study 1; p.238): "I love the fact that the plants are scented. The garden tickles all your senses. And it's nice to be able to smell as I can't taste anything at the moment."

The fragrance of plants also aroused curiosity and lifted the people's spirits. Staff stated that the sweet fragrance of a particular blooming plant was carried by the breeze, and some people were coming to ask about the source of this smell because it lifted their feelings and spirits (Study 1).

Apart from the plant and garden-originated fragrances, the smell of burning wood on the fireplace was also associated with a powerful feeling of coming home (Study 3).

The most important feature of smell was the recalling power of personal past, people felt safe and homely because the smell reminded them of their personal experiences. The smell of space was employed as a tool by the designers. They avoided passing on the smell of the hospital where the visitors usually had time that they did not want (Study 2). Thus, visitors were smelling the spiritually rising natural fragrances in the centre rather than the smell of medicine, so this olfactory experience triggered sometimes a sense of being relaxed, some others a sense of belonging by recalling memories from personal past (Study 1). A member of staff explained how she felt while sitting on the porch (p.256):

> *The jasmine reminds me of Tunisia when one night it rained and the scent of the jasmine was very strong. I have that memory. It is very sensory. In summer you can smell the jasmine in the courtyard.*

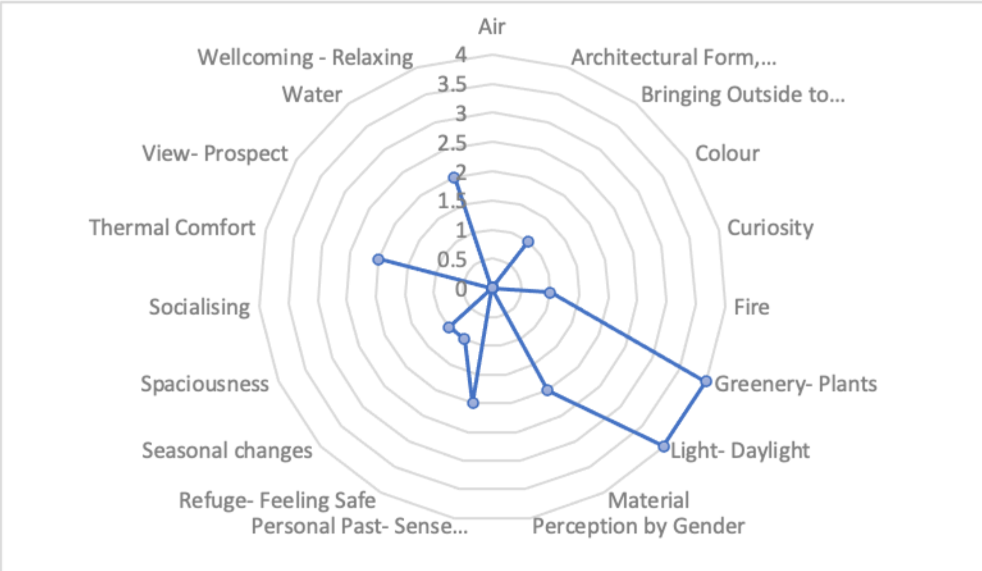


Figure 5-22: References to Olfactory Experience, and interrelation with the other codes referred together.

b. Auditory Experience: Sense of Hearing

In Maggie's Centres' case, as a meditating support centre, silence enhanced the quality of the auditory experience more than hearing voices. People stressed the quietness felt in the centres due to some sound attenuating design features (Studies 1, 2, 3, 6). Interviewed designers pointed out their effort for creating a noise-proof atmosphere via buffering with the greenery (Studies 1, 9, 12), the double-glazed curtain walling system and the integrated asymmetric acoustic panels (Study 3). Although the sound-proofing precautions worked at a great scale and visitors were happy with the noiselessness, some deficiencies were reported in the interviews. The architect of Maggie's West London, Ivan Harbour, observed the following after regular visits to the centre: "We had wanted to keep the outside noise down by bouncing sound off the walls. However, the roof bounces the sound in, so it's not as quiet as we expected" (Study 3). Likewise, permanently preventing all traffic noise from the vicinity was not possible at the centres located in the heart of an urban area. Interviews in Study 4 reported the noise problem in an open-plan centre (p.529):

> *Users tolerated the noises, as they liked being aware of other activities without participating. Yet, they brought up some privacy issues, for example, acoustic problems during meditation sessions and consultations. This highlights the importance of modifying acoustic relations, as in certain situations, users might feel the need for a soundproof space to withdraw to.*

However, the noise was not perceived the same by everyone. In Maggie's West London, a female visitor said (p.249): "It's right in the middle of London. The noise of the traffic is somehow ameliorated. That's what that garden is – it's a reassurance." Another female cancer patient expressed a very different experience (p.249): "I love the garden when people from the hospital come and plonk themselves down. There is always the noise of the traffic but that is just the way it is" (Study 1).

The sounds had a similar impact as the smells in terms of recalling memories that helped to improve feelings of welcome and relaxation (Figure 5-24). The most commonly mentioned sounds originated from the gardens: the moving and rustling tree leaves, branches, and plants (Studies 1, 6); patterns of rain on the huge leaves (Study 12); joyful singing and chirping of birds (Study 6); bumble of bees (Study 1); chickens crowing (Study 4). The gardens were "never dead" with all these movements and sounds, this aliveness made the cancer patients' feelings uplift while they were endeavouring to survive (Study 1). Also, people confirmed they enjoyed the sound of water elements, which made them feel relaxed, calmed down and welcomed. In Study 1, a patient chose the designed water pool as her favourite part of the building (Figure 5-23) and said (p.250): "The calming sound of water as you walk to the centre. This is a new feature. It is rather lovely. I love the sound going onto the pebbles."

Figure 5-23: The water pool in Maggie's Cheltenham (Study 1).

Interestingly, the lack of a water sound was criticised by a member of staff in Maggie's Dundee (Study 1) who identified sound and presence of running water as something missing as an important factor to complement the aims of the centre's environment (p.251):

> *I would love a water feature. Down by the bench there [below the terrace]. You would also hear it on the terrace. Something simple with the noise and the effect of running water. That's the thing missing.*

As in all codes, the designers did not want to bring any resemblance between clinical environments and hospitals through the auditory experience either. The announcements, shouting names, and constantly ringing phones, in short, all the usual background noise of the hospital environment was replaced by quiet atmospheres which were encouraged to include natural sounds (Study 2). According to all these published studies, Maggie's architects were substantially successful with the auditory experience and creating a welcoming, mutable and lively atmosphere in Maggie's Centres. To sum up the sense of hearing, an interviewee described her sound experience in the following way (Study 2; p.4):

> *I always described Maggie's as having lots of different voices, and so there are days I'll go over and you feel OK to chat to people because it's just lots of conversations of relaxed things. Other days you'll go over and it's a quiet building because there are lots of separate very personal conversations going on, and then other days you'll go over… it's really loud and it's full of laughter and they're all teasing. So, it has lots of different voices and I think that for me is the really lovely thing about it, that it just translates. On the same day, it can be four different things and it takes it, the building can take it and hold it and it's good.*

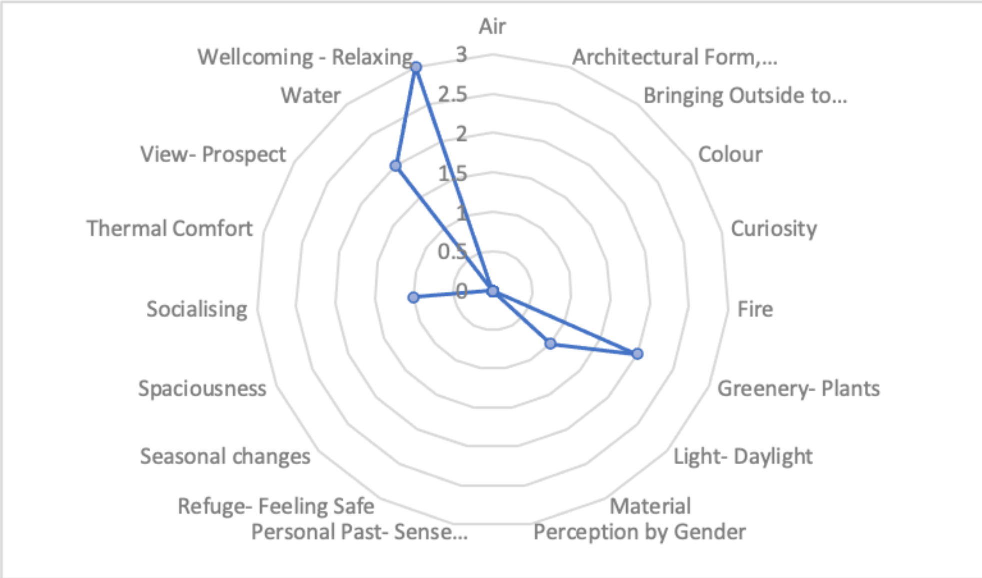


Figure 5-24: References to Auditory Experience, and interrelation with the other codes referred together.

c. Tactile Experience: Sense of Touch

As happened in all other sensory experiences, one of the main sources of a sense of tactility came from the gardens and green spaces, where the users felt their connection with softness or gentleness (Studies 1, 2, 6). Apart from the wood trunks of trees in gardens, the warmth of wooden materials inside was also indicated specifically (Figure 5-25). While a patient was describing the womb-like feeling of Maggie's Centre, she stressed the importance of the tactile feeling of wood: "I love wood, I think it's very tactile, I can't go near it without touching it" (Study 2). Even though the interviews did not specify any other particular material, the choice of material, and their textures and tactile qualities were widely appreciated. As shown in Figure 5-26, these qualities prompted a welcoming and safe atmosphere that offered warmth and greeting (Study 2).

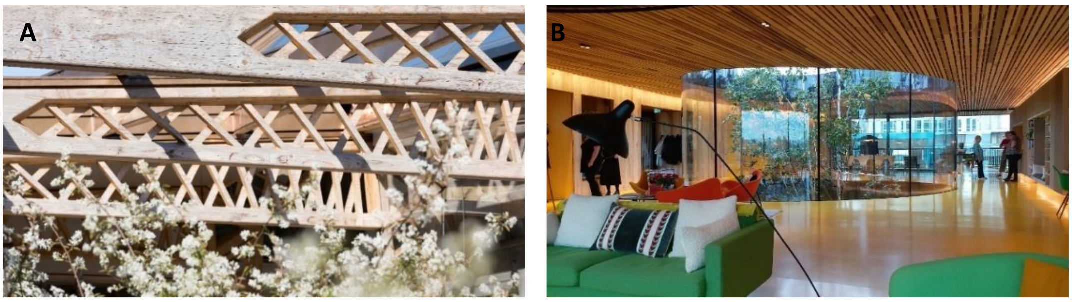


Figure 5-25: a) Maggie's Manchester, b) Maggie's Oldham.

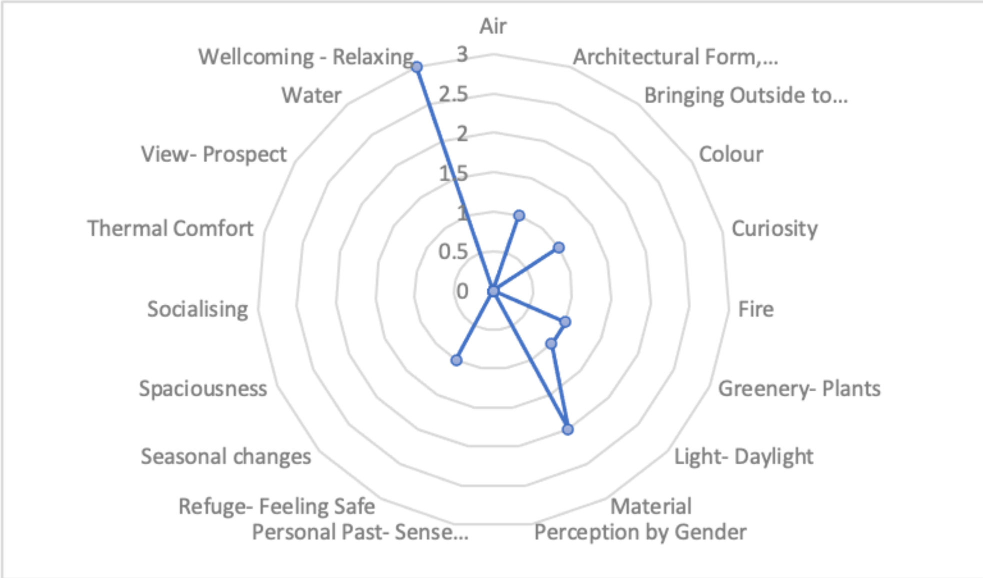


Figure 5-26: References to Tactile Experience, and interrelation with the other codes referred together.

Lastly, looking at the multi-sensory experience, Maggie's Centres effectively used natural elements and their relation to elicit sensations. The gardens took the lead in terms of multisensory experience as well as all the senses individually by providing a direct connection with nature. The gardens were the environment where users experienced a higher diversity of stimuli coming from fragrances, sounds and textures, enhancing the feelings of relaxation, greeting and safety and encouraging them to continue their therapies and fight death (Figure 5-27). This sensory experience explicitly was claimed to calm them down and lift their spirituality during their fight to survive (Studies 1, 3, 4, 5, 12). A male cancer patient described the healing effect of the garden with its sensory richness in this way (Study 6; p.703):

> *The garden and green spaces are areas to take you away from the hustle and bustle of everyday life and give you the opportunity to stop, look around and appreciate nature. Admire the blooms, enjoy the fragrance, listen to the joyful singing of birds, feel the wind and warm sunshine on your face. This takes you away from cancer and who would dare to say it does not help in the healing process?*

The landscape architect of a Maggie's Centre explained the multisensory experience they aimed to offer in the garden (Study 12; p.97):

> *There are these huge leaves in one of the courtyard gardens, so when it rains you get this 'patter' on the leaves. Then there is the perfume, so that recurs again, again and again in the garden, and then there is taste, so in all the gardens there are edible things. So, by stimulating people's senses you just very naturally get them to tune into a place.*

The wood-burning fireplaces, with the smell of burning wood and the crunching sound of it, (Study 3), and the water elements (Study 1) also helped to multisensory experience in Maggie's environment.

It was a key principle for architects and designers to design the centre as much different as possible from the hospital environment, and in order to do so, they aimed to heighten and uplift the senses (Study 4). As all the responses showed, they succeed in stimulating the senses by using natural elements. A member of staff, a cancer specialist, described the multisensory environment of a typical hospital environment as opposed to the distinguishing characteristics of Maggie's Centres (Study 2; p.4):

> *[Typical hospital environments] smell a certain way, they look a certain way, the phone's constantly ringing, there are buzzers going off, always… so the situation you were in with other people at hospital was that they started to feel that they were an irritation if they were asking you something because they can hear the buzzer go, they can hear the phone ringing, there's somebody shouting your name down a corridor, all that kind of stuff, everything is all, in those environments is all about moving you away from the situation you're in.*

Eventually, all the emotional effects of these sensory experiences were also supported by the recalling feature of multisensory experience. People felt familiar with the environment based on their personal past, and their own memories of their past experiences. Some of them smelled the same flower that they experienced during their holidays; some of them heard natural sounds that reminded them of their hometown, and some others sat in front of the burning wood as they used to do in their childhood home. Thus, this sense of familiarity triggered in turn the sense of feeling at home welcomed and calmed.

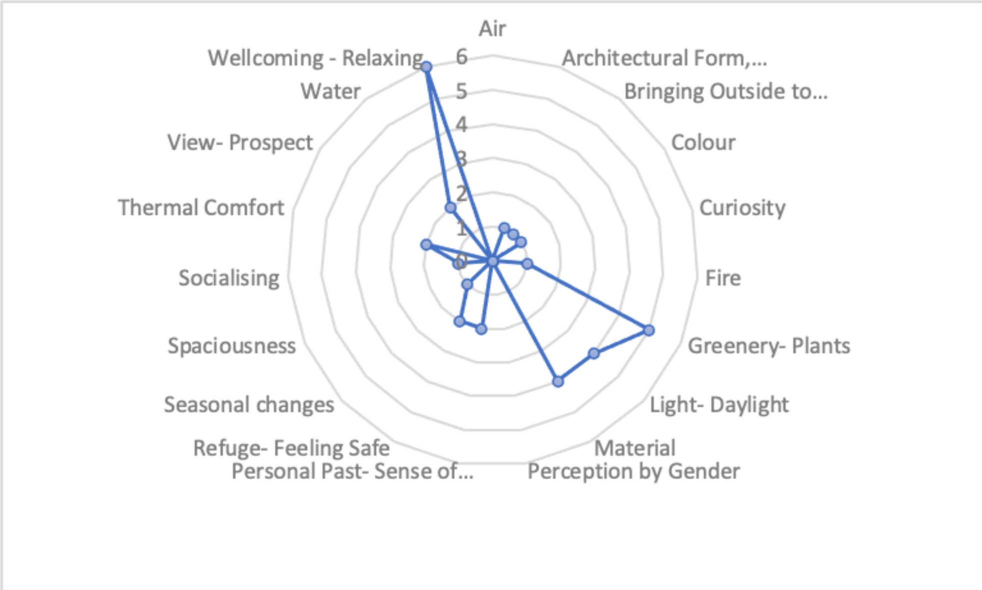


Figure 5-27: References to Multi-Sensory Experience, and interrelation with the other codes referred together.

5.2.3.5. Materials

Maggie's architecture used different materials to create welcoming, warm and safe places, which were also employed to attract attention and curiosity in some cases. Materials, in general, were seen as a greeting part of the centres with their texture and tactile features (Study 2). For instance, the surface materials were warm to touch (Study 7). The soft and natural materials stimulated users' feelings and brains by fascinating them (Study 8).

Wood was likely to be the most mentioned material by the interviewees. Wood as a building material for structures and surface finishes was welcomed by many of the patients and commonly mentioned for its 'warmth' and 'natural feeling', which 'settled their mind' (Figure 5-28a) (Study 1). Wood and timber trusses were also associated with a high quality of architecture, as they drew people's attraction and created a retreat space where they felt safe and relaxed (Figure 5-28b) (Studies 1, 2). Wood was widely appreciated as a soft material by both the visitors and the staff (Study 8), and it was mostly just 'loved' without defining any reasons or specific feelings. An example of the expression of the emotional impact of wood materials reported by a patient in a focus group (Study 2; p.5):

> *I love wood, I think it's very tactile, I can't go near it without touching it. I just love it, and if I was coming in as a centre user and I needed time to myself, I would hide myself in there, because I feel it is womb-like and comforting. I just, I can't say enough about it, I just love it.*

Figure 5-28: a) Maggie's Highlands, b) Maggie's Manchester.

Even though concrete was seen as a cold and unpleasant material in general, this study revealed in which conditions concrete as a material was welcomed by the interviewees. People usually came with prejudice about concrete, a patient expressed his first impression about a centre made of concrete as (p.5): "if you described it to me and gave me a percentage of how much of this building was concrete I'd be thinking really, it wouldn't work", and he went on how the building was clever with its design, colours, fittings and natural features, all together made him feel safe and welcomed (Study 2). Another visitor explained how much he/she loved the building and the concrete parts which were like little legs that made him/her feel sheltered, thanks to the designer's clever touches (Ibid.). The interviews in Study 2 disclosed the reality of creating warm and alive spaces by using cold and sharp materials, a visitor expressed the reason why these materials were not unpleasant in Maggie's Centre (p.6): "The glass, the angles, the concrete, the exposed materials, but it's all softened, not by textiles but by nature, because you've got that lovely garden…"

Also, concrete was used *ad hoc* to attract men to Maggie's Newcastle, increasing the number of male visitors by eleven per cent. The head of the centre explained how the architect became successful due to the clever inclusion of concrete, which was not 'girlish', therefore, the architect designed the interior in concrete walls which were juxtaposed with timber for softening edges, while using Corten steel cladding panels (Figure 5-29) (Study 9).

Not only concrete but also the use of different materials, in general, would attract the men's attention. While a centre head expressed that the male visitors noticed the wood material far more than the female visitors (Study 2), a cancer specialist staff provided the following observation (Study 5; p.1):

> *This building works for men better than I've seen elsewhere. They get intrigued by how things, the materials that have been used and things like that, they very quickly offer you an opinion on it. It's a door opener, it's far better than a half-hour preamble about football*.

Figure 5-29: Maggie's Newcastle.

On the other hand, the texture or appearance of materials was not the only attraction for the users, also the creativity with which materials were used and the craftsmanship of the workers were pointed out. An architect interviewee reported that all materials during the centre's construction were raw, thus, the construction workers showed their creativity and professionalism in the production of the building (Study 2). The creativeness of the woodwork and the curves were interpreted as the centre was built with 'love' (Ibid.).

The architects used warm and soft materials, or softened cold materials, as a tool to create a homely atmosphere in order to distinguish these environments from the usual healthcare environments. The responses showed that warm material choices and the quality of craftsmanship in the centres were successful for this purpose: they were found welcoming, safe, warm and homely (Study 2). The plaster walls and ceilings, an oak floor and familiar domestic furnishing were given as examples of how the interior design created a non-institutional feeling by an interviewee (Study 7). Another goal of some architects was to create a visual focus for the visitors to enhance their mental state; they used materials along with unconventional architectural forms for this purpose. In Maggie's Dundee, the timber ceiling attracted people's eyes to its organic shapes (Figure 5-30); while in Maggie's South West Wales, the ceiling with its glass rim allowed people to focus (Figure 5-31) (Study 2). The material choices were mainly appreciated in the interviews. However, the only negative comment was about the plastic chairs in the centre which were not comfortable

(Study 3). An architect interviewee summarised what he avoided in terms of material choice (Study 2; p.4): "The worst thing you could do is have vinyl on the floors and those blue chairs…"

Figure 5-30: Maggie's Dundee timber ceiling.

Figure 5-31: Maggie's South West Wales with the glass rim on the ceiling.

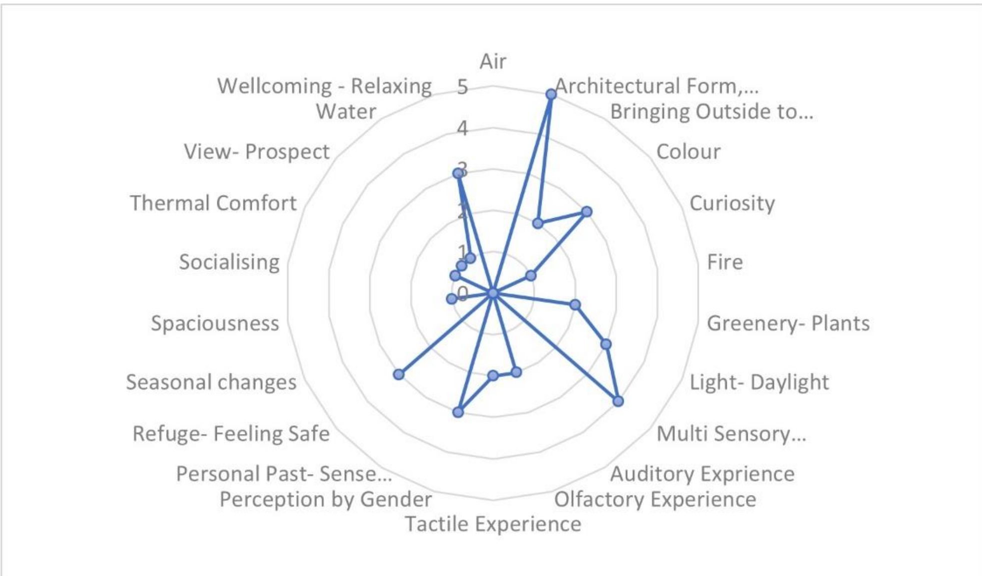


Figure 5-32: References to Material, and interrelation with the other codes referred together.

5.2.3.6. Colour

From the visitor’s point of view, the colour of the centres was often referred to as a distinctive feature from clinical healthcare settings. Their statements about colours were usually followed by a comparison with other healthcare facilities, particularly hospitals. Quite a few people mentioned the orange-red colour of Maggie’s West London where this striking colour was used for arousing curiosity and attracting people. When people left the hospital, this orange-red colour was attracting their attention where everything was expected to be white, grey or redbrick on the usual hospital campus (Studies 1, 2, 11). The orange colour shocked some patients; however, they were quite happy about this colour owing to the that it gave life around (Study 11). A visitor interviewee defined how she was feeling safe (Study 1; p.294):

> *I came first with my daughter and I loved the orange. It is such a huge jump from Charing Cross Hospital and you immediately feel somebody cares about you. Like someone bringing you a cup of tea in bed. It was the coming in, the huge wall to enclose it and to isolate it from the horror of the hospital.*

Some responses referred to the interior painting as well. The splash of warm colours and tactile texture of materials at the entrance were also stated as engendering elements of feeling welcome and the warmth of the greeting (Studies 1, 2). A response indicated that colourful decoration gave a sense of family and invited them with feelings of welcoming and relaxing. A psychologist staff member told that different themes of these buildings helped people to look from a different perspective, so she/he was delivering therapy every time in different rooms painted in different colours (Study 2).

Along with greenery, light and air, colour was associated with emphatic spaces that engendered pleasant thoughts and feelings, and a strong sense of welcome, contrasting to most healthcare environments (Study 1). Colour was generally emphasised regardless of the different types of colour, but people did specifically refer to their characteristics, such as “the colours are so vibrant”, “contrast colours” (Study 1), “splash of colour”, “lots of quirky colours”, “colourful” (Study 2). People liked the feeling of not recalling the hospital environment where they usually just left before entering this safe sanctuary, thus, they did not care that much about which colour it was painted, but how these colours were different from a hospital environment. Another visitor proved this view with his/her response in Study 2 (p.5):

I think the lack of colour made me feel a wee bit uncomfortable, because then it was really stark, wasn't it? They've only recently just started to get the pictures on the walls and things like that. It was very clinical then, it's warmer now, but it still needs a bit more work to it.

In all analysed interviews in this study, it was clearly indicated that visitors expected a colourful effect from Maggie's Centres. For instance, although her centre's building was colourful, a visitor complained about the lack of colour in the garden and recommended planting bulbs and tulips (Study 1).

According to the analysis, Colour was mostly connected to the codes Welcoming-Relaxing, the Architectural Forms, Layout and Furnishings, and the Light-Daylight (Figure 5-33).

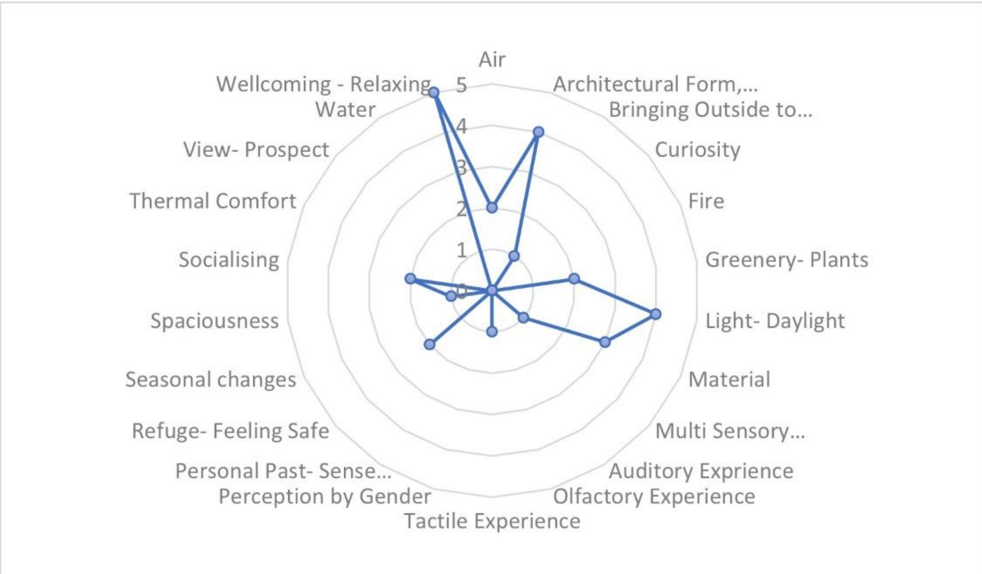


Figure 5-33: References to Colour, and interrelation with the other codes referred together.

5.2.3.7. Bringing the Outside to the Inside

The connection between outside and inside environments was highly appreciated by people in these studies. Basically, the two main features of the centres associated with the way of creating a connection with the outside were gardens and windows. Bringing the outside to the inside was considered as easy access to the garden, just through the doors or having no barrier between the outdoor garden and the indoors, while the gardens were seen as barriers between hustle and bustle of the outside world and the centre (Study 1). Garden and building connections were commonly embraced as the interviewees saw the gardens as an extension of the inside of the centres (Ibid.). An interviewee, who walked around the building every day and examined it, told the reason for examining it as the building had a very strong connection with the outside and garden, therefore it was always changing (Study 2). While the majority of people mentioned the inside-outside connection via windows (Studies 1, 7, 10) some others also emphasised the operable doors, amount of glass, balconies (Study 7), terraces, and indoor gardens, plants and trees (Figure 5-34) (Study 1). The most noticeable factor of this inside-outside effect was the affordance of visual connection, such as a view of the sky, water, or greenery. The multisensory experience was also highlighted, such as feeling the warmth of sunlight, scented plants (Study 5) or the warm breeze from open doors (Study 1).

The benefits of the inside-outside connection were also extracted throughout all responses from the interviews. A staff member expressed the importance of this connection as some people did not have the energy to walk around, thus, they found an opportunity to have access to nature while being inside (Study 1). Figure 5-35 showed that the Bringing the Outside to the Inside code is highly associated with the Welcoming-Relaxing code. According to interviewees, the inside-outside connection made the centre calming, peaceful (Study 8), welcoming, inviting, safe place, house-like (Study 1), relaxing, uplifting and healing (Study 10).

Figure 5-34: a) Maggie's Gartnavel, b) Maggie's Fife.

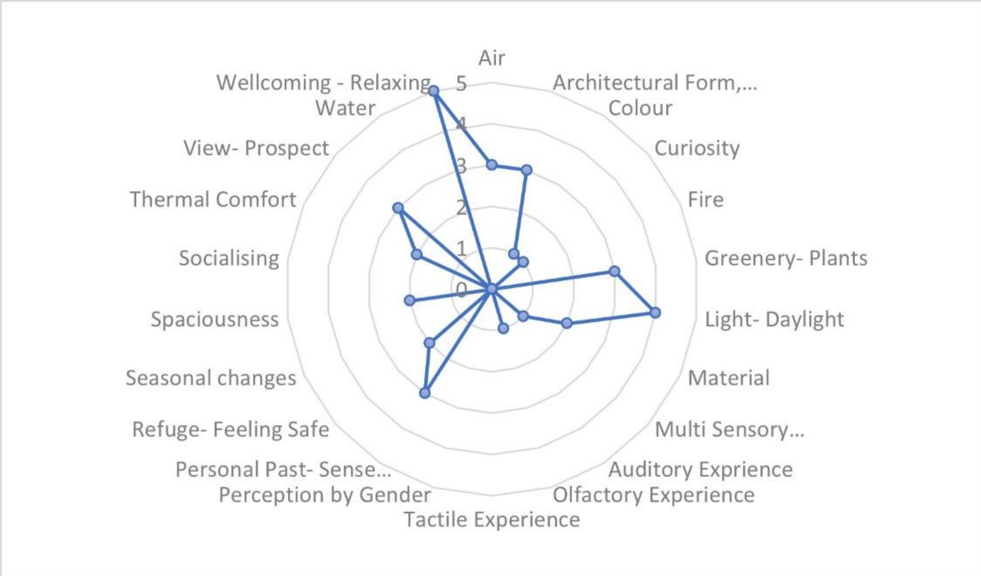


Figure 5-35: References to the Bringing Outside to Inside, Furnishing and Fittings, and interrelation with the other codes referred together.

5.2.3.8. Spaciousness

According to the analysis shown in Figure 5-36, the code Spaciousness was by far the most associated and mentioned together with light-daylight (Studies 1, 2, 4, 7, 8, 11, 12). The interviewees considered bright and spacious spaces as features of healing environments due to their calmness and peace impacts (Studies 8, 11), and these two elements created a sense of space (Study 1). Qualitative evidence suggested that spaciousness and light are contributors to relaxation and stimulation that made the users physically feel good (Study 4). According to an architect interviewee, little things like the ceiling height and the amount of daylight greatly improved the quality of space and the perception of spaciousness (Figure 5-37) (Study 2). On the other hand, the high ceilings and the big windows that expose the light and allow clear view was frequently defined as the main constituents of spaciousness (Studies 1, 2, 4, 8). The airy spacious rooms helped to stop claustrophobia and to reduce the feeling of stress (Study 1). Study 8 stated that spaciousness was a major feature for energising the centres, a participant expressed the feeling of spaciousness (p.5):

> *There's something about having space above your head. It is almost like your thoughts feel less in your head. It's almost like they expand out. So physically that's something, I think, that makes you feel better.*

The architects of Maggie's Glasgow, Office for Metropolitan Architecture (OMA), stated that they wanted to create a relaxing atmosphere which was a very important feature for cancer patients according to their background research, so they decided to design the centre around a very big homely living room. Therefore, one of the main features they aimed for in this design was spaciousness (Study 4). Also, spaciousness with the explosion of volume was used for evoking curiosity and a feeling of welcome.

Figure 5-36: References to Spaciousness, and interrelation with the other codes referred together.

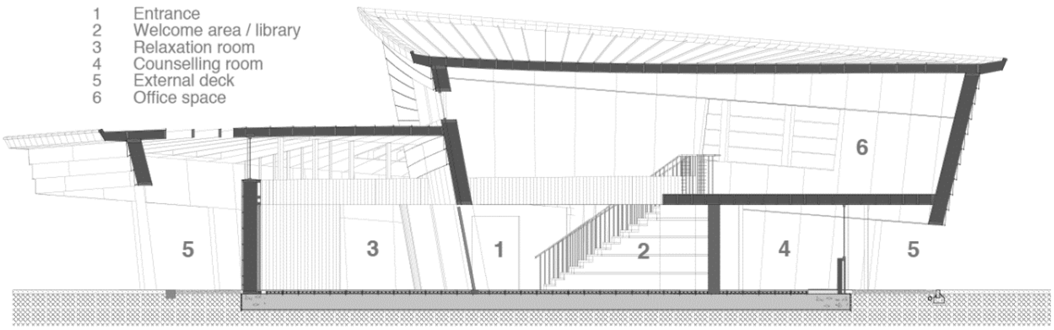


Figure 5-37: Maggie's Highlands section.

5.2.3.9. Air

People explicitly mentioned or implied the term *air* only in 11 responses, which was less than expected. This could be due to being an indiscernibly common element for living organisms, which could lead to being easily ignored by the users' perspective. However, fresh air and air-flow features were mentioned by some visitors and professionals. These responses were quite helpful to have an obvious insight into some design principles and outcomes.

Fresh air's impact became much more perceivable when users got physically in contact with open spaces, gardens, winter gardens and balconies because the notion of fresh air intensity was higher in these spaces. Therefore, the air was mentioned most commonly together with greenery and light.

Compared to the other codes explained in previous sections, people did not provide a lot of comments about outcomes related to fresh air. However, they expressed that fresh air was one of the reasons they were spending a lot of time in these particular locations, such as the winter garden, balcony or garden, above all in the warm weather (Studies 1, 10). Two people connected these spaces with feeling relaxed and feeling at home (Study 1). A member of staff observed that the balcony was her favourite time spending spot, as she felt protected there due to the plants, the fresh air and the sunshine (Study 5). Specialist staff also commented, in terms of therapy techniques, that Maggie's better suited to art therapy thanks to its very airy and light environment (Study 3).

The entrances were another space commonly emphasised by visitors as welcoming and encouraging. Being airy was also mentioned along with the greenery, natural light and colour. One of the visitors claimed that the approach to the building had a "winding country feel" which slowed people down and gave them time to relax in there and encouraged them to get into Maggie's (Study 1).

As predicted, the air was also associated with thermal comfort. In the interviews, a cancer patient told that chemotherapy made them very sensitive to the cold, so he/she referred to the indoor garden as a sheltered place for a feeling of being outside with fresh air, plants, and light (Study 1). Another staff member defined the indoor spaces as "it is literally breath of fresh air" while explaining the room with its outside connection and the perception from the centre to its surroundings (Study 1). Some visitors also said that when the doors opened, a breeze of fresh air from water elements (the river Chelt and the fountain in the garden) made them feel an inside-outside effect (Ibid.). Likewise, these comments displayed the connection between 'bringing outside to inside' code and air as well.

Maggie's London was mentioned in another comment in relation to its cross-flow natural ventilation system, which offered a comfortable indoor environment, thanks to manually opening well-positioned big sliding doors and top-hung windows (Study 3). A visiting engineer explained the good ventilation of the centre (p.7):

Entering Maggie s West London feels like entering someone's house, and this is reflected in the minimal layout of its HVAC services. A simple but effective extract ventilation system, fully integrated to the wall lining, gently forces fresh air in from the main entrance doors and moves it across the main social space, where it merges with fresh air entering the space through other routes.

As expressed at the beginning of this section, an engrained function for human beings might have been widely neglected by interviewees. Therefore, it can be deduced that the air quality of Maggie’s Centres was successful, as people did not notice it. Otherwise, some symptoms (e.g. Sick Building Syndrome) or complaints could have been reported, because some crucial aspects of air quality may attract attention once they are absent (e.g., odour).

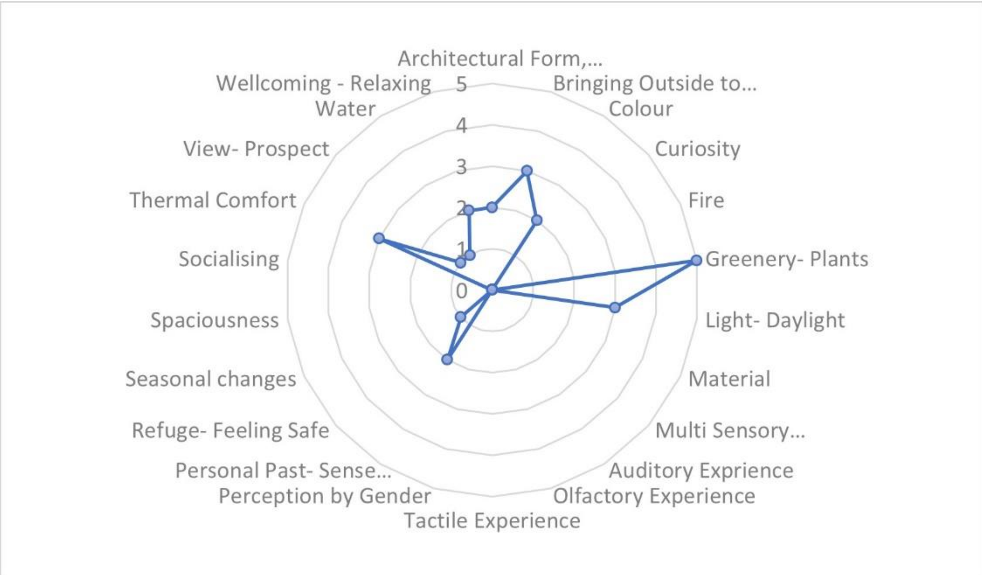


Figure 5-38: References to the Air, and interrelation with the other codes referred together.

5.2.3.10. Seasonal Changes

The seasonal changes were observed frequently, above all in connection with the gardens, where the impacts of daylight and plant mutations over the annual cycle are most perceptible (Figure 5-40). The interviewees stated that the gardens reflected these changes either through strong scents, blooming flowers, dew drops, rain or snow, and sometimes through pristine colours (Study 1). People remembered their first visits in association with the seasons: “It was snowing” or “I came here first in the spring. The magnolias were set against the orange” (Study 1). The natural flow of the garden showed the expression of the seasonal changes in the centre, which was referred to as relaxing for some of them and reducing the stress level. For most people, daylight was the most important element that represented the seasonal changes, daytime or climate. A staff member, who had worked in a closed hospital environment for a long time, stated that the view of the sky and the perception of daytime and the seasonal changes had a powerful stress-reduction impact (Study 1). The majority of responses praised the feeling of seasonal change inside the buildings and in the gardens. However, a member of staff complained that the garden lacked seasonal changes in Maggie's Dundee, which was composed of only a meadow and azaleas, instead of a variety of plants; likewise, a male visitor who had cancer also criticised the garden in the same centre and reported how important the perception of seasonal changes was for the cancer patients (p.232):

> *In winter the garden looks drab and into December, January and February there is little of interest. Where are the snowdrops and crocus to give brightness and hope for the forthcoming year? Where are the daffodils followed by tulips to reinforce the feeling of a renewed life? That is what cancer patients wish to experience, hope for the future.*

Figure 5-39: Maggie's Dundee.

Figure 5-40: References to Seasonal Changes, and interrelation with the other codes referred together.

5.2.3.11. Thermal Comfort

Thermal comfort was mainly mentioned together in conjunction with air quality, however, there was no significantly outstanding connection with any particular codes (Figure 5-41). Although the overall thermal comfort quality was praised, the feeling of thermal comfort was an objective evaluation, so some of the comments proposed slightly warmer or cooler places. Cancer patients highlighted the fact that they were very sensitive to the cold due to chemotherapy side effects (Studies 1, 3), thus, thermal comfort was more important in Maggie's Centres compared to standard design principles. A patient pointed out that the temperature was comfortable, and particularly welcoming with the wood fire (Study 3). In the cold weather, the thermal comfort was comfortable and watching the outside while being warm inside was found relaxing by a patient (Study 1). The indoor garden was especially appreciated in connection with providing thermal comfort that allowed people to enjoy the feeling of being outside and encouraged the connection with green elements in cold weather (Ibid.). Also, manually opening windows and sliding doors helped people to feel relaxed since they can intervene in the room temperature or air quality (Study 3).

On the other hand, in Maggie's London, the upper level was warmer than the lower level when the underfloor heating system was in operation. Also, people reported that one of the activity rooms was getting significantly warmer than the other rooms (Study 3). Therefore, one of the critiques regarding thermal comfort was about the consistency of temperature in different parts of the buildings. Another suggestion by a visitor was to block the wind in the garden by using benches (Study 1). An architect indicated that they avoided reaching a temperature of 24°C to not remind a hospital ward (Study 2).

Figure 5-41: References to Thermal Comfort, and interrelation with the other codes referred together.

5.2.3.12. Water

The most important design goal of the water elements was to stimulate the sensory experience (Figure 5-42). Water triggered the senses through its sound and visuality. People stressed the calming and relaxing impact of water elements in the gardens (Study 1). A female cancer patient in Maggie's Edinburgh expressed her experience with water elements (p.250):

> *The bamboo and water feature give a calm, zen-like aura which settles the mind as you enter Maggie's – a connection with nature is a connection with life.*

A cancer patient interviewee in Maggie's Cheltenham described the sound of water as 'always tranquil' (Study 1). Also, the rivers or the lakes close to the centres projected their smell and sounds to the centre, apart from providing a view (Ibid.). The water elements had also a welcoming impact by slowing down the visitors (Study 6; p.701):

> *Walking down the path with the fountain—it's coming on a little journey. I always stop and look at that and think about the water going all the way back again. I always follow the curves in my mind. It's a stopping point for me. I instinctively do it. I don't think about it*.

On the other hand, the absence of a water element was pointed out by a member of staff in Maggie's Dundee, she claimed the sound and streaming effect of water was missing at the centre (Study 1).

Figure 5-42: References to the Water, and interrelation with the other codes referred together.

5.2.3.13. Fire

Fire was classified as an element of biophilic design by Kellert (S. Kellert et al., 2011; S. Kellert & Calabrese, 2015); however, its use in the designs of Maggie's Centres was quite restricted. The designers used fireplaces in Maggie's Centres to create a warm and homely atmosphere where people can gather around, thus, the fireplaces encouraged social interaction (Figure 5-43) (Study 4).

While the people's personal past, namely, defined what home means to them, was supporting the homely feeling, the environment encouraged a sense of belonging (Figure 5-44). Along with creating a homely, safe and socialising environment, fire unsurprisingly supported opinions on thermal comfort. As cancer patients, the visitors stressed their sensitivity to cold, so they found the fireplace very welcoming and comfortable (Study 3).

Although the gas fire was commonly used by the centres' designers, the first wood-burning stove was used in Maggie's West London, and some other new centres were designed with the wood-burning stove too. Therefore, the multisensory experience was supported by the warmth and smell of fire; particularly these qualities of wood fire fascinated some of the interviewees (Study 3).

Figure 5-43: Fireplace a) Maggie’s Manchester, b) Maggie’s Cardiff.

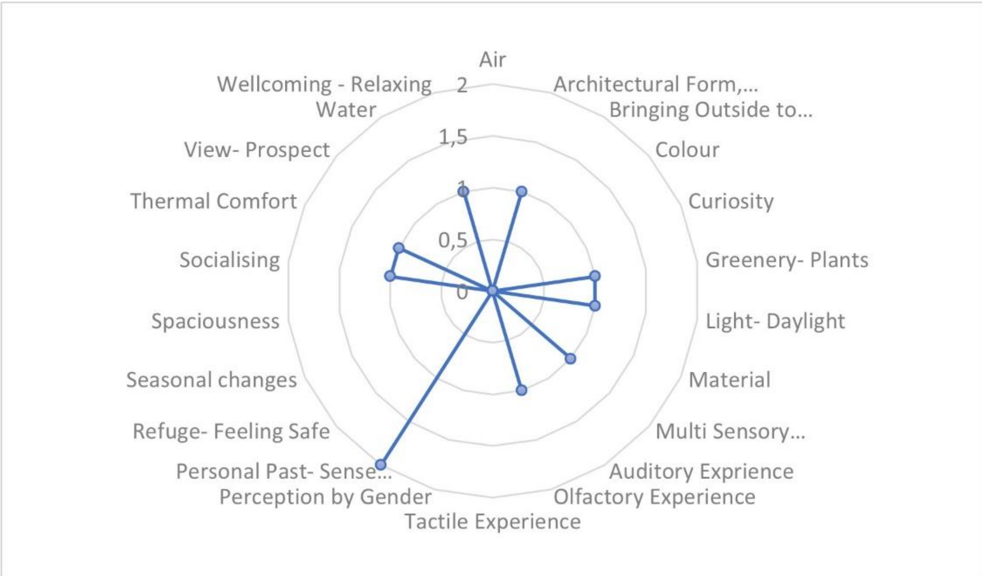


Figure 5-44: References to Fire, and interrelation with the other codes referred together.

5.2.4. Interaction Between Outcome Codes

The identified Outcome codes have been explained in the previous section in connection with the Interventional codes. However, apart from Perception by Gender, all Outcome codes were also interrelated, showing different degrees of connection, as represented in Figure 5-45.

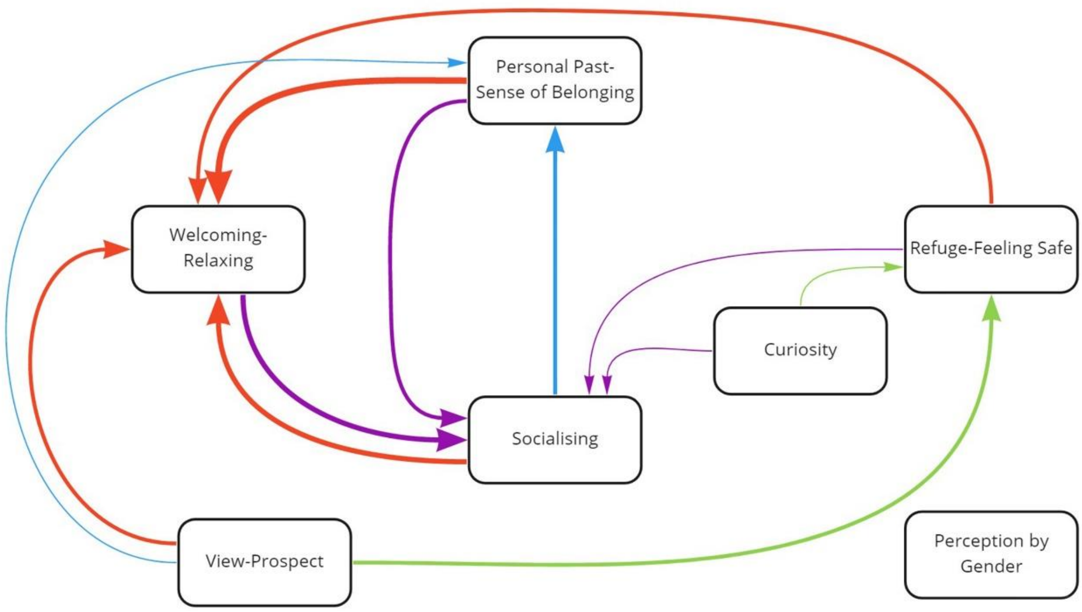


Figure 5-45: Interrelation of Outcome codes (Thickness of arrows illustrates the importance of connection based on this study. All arrows targeting the same code are represented with the same colour).

The analysis showed that there was a very strong connection between the personal past of the users and their welcoming and relaxing perceptions of the space (Table 2). The interviewees expressed very frequently that they felt like ‘coming home’, therefore they had a feeling of being welcome and safe when they entered the centres (Studies 3, 4, 7, 8, 10). One of the reasons why they associate Maggie’s centres as a homey environment was their actual personal and cultural perception of what home means to them and their families. Therefore, there was a strong connection between the sense of belonging, a biophilic design attribute, and the feeling of welcome and relaxation.

The creation of a homely and non-institutional environment was referred to as the main design strategy to arouse these feelings too. People calmed down and felt relaxed because the building was quite different from usual healthcare settings in their memory, while quite similar to the feeling of a home that they got used to. Therefore, the users’ personal past and sense of belonging became highly associated with the welcoming place and feeling relaxed code (Studies 1, 2, 3, 4, 7, 8, 12).

On the other hand, Personal Past and Sense of Belonging engendered and supported refuge and feeling safe the most among the codes (Figure 5-48). (Studies 1, 2, 3, 8, 13). Hence, the centres provided safe environments where the users had the feeling of refuge which triggered feelings of relaxation and welcome.

In terms of the outcome codes, Socialising was the second most associated code with the feeling welcomed and relaxed after the sense of belonging (Figure 5-46). Regarding the responses, these two codes, the socialising and the welcoming-relaxing triggered each other. While the feeling of socialising with people, and feeling the freedom of speech and expression made patients relaxed and adapted to space, the feeling of welcome and peace let them talk and socialise with people (Study 1, 2, 7, 8).

Apart from codes the curiosity and perception by gender, all codes had more or less connection with the code welcoming-relaxing (Figure 5-46) and evoked the feelings of greeting, welcoming, relaxation, calm and peace to different extents.

To sum up, according to the responses, views and prospects triggered feelings of welcome, relaxation (Studies 2, 3, 4), and curiosity (Study 4). Also, a successful balance between prospect and refuge helped people feel safe (Studies 1, 4).

5.2.4.1. Welcoming Place- Feel Relax

Welcoming place and feeling relaxed was the most outstanding code in all codes that had connections with 20 other codes with 71 references (Figure 5-46). These two feelings were highly connected and supported each other, thus, they were examined in the same code. Although the atmosphere and the overall centres were referred to as welcoming and relaxing, the results showed that this code was also a conclusive outcome of the other feelings. Such as feeling safe or a sense of belonging stimulated the feelings of relaxation and welcomed, or daylight, architectural form, furnishing, greenery, etc. enhanced the non-institutional feeling which promoted the feeling of relaxation or feeling safe. All these senses were interrelated to each other. Consequently, the feelings of welcome and relaxed were the most mentioned Outcome in the interviews because it was one of the most aimed aspects of the Maggie's Centres designers (Study 4). The terms 'calm', 'relaxing', 'comfortable' and 'welcoming' were the most frequently used descriptions for centres by their designers (Ibid.).

Secondly, the architectural layout, furniture and fittings were designed in order to create a homelike environment, and according to the visitors' responses this approach worked and stimulated the feeling of welcome and greeting, and people felt relaxed and calmed down in the centres (Studies 1, 2, 3, 4, 7, 8, 11, 12). Architectural forms, planning, elements and furnishing and fittings, which supported the feelings in question, were explained in detail in 5.2.3.1.

The gardens were places where the people had a direct and the strongest connection with natural elements. The visual and sensory connection with the gardens and greenery stimulated people's feelings whether they were outside or inside the buildings. As explained in 5.2.3.3, the green elements had a remarkable impact on calming the people and made them feel relaxed. Particularly before entering the buildings, the gardens and plants slowed the patients down and greeted them (Studies 1, 3, 5, 6). The daylight exposure (see 5.2.3.2) had a similar impact with the greenery, it increased spending time at the centre by greeting visitors and evoking feelings of relaxation, peace and calm (Studies 1, 3, 5, 6, 8, 13). The sensory stimulations; the multisensory experience (Studies 1, 2, 3, 6), the auditory experience (Studies 1, 2, 6), the tactile experience (Studies 2, 6), and the olfactory experience (Studies 3, 6) had strong roles on to evoke welcoming and relaxing feelings.

Owing to explained in detail in all codes separately above in section 5.2.3, this section looked into the responses that explained the welcoming and relaxing impact of Maggie's Centres regardless of the other codes.

In order to explain the reason why Maggie's had a welcoming and relaxing impact, the visitors usually referred to the atmosphere and energy of the centres (Study 11; p.5): "Ooh my god this is gorgeous feeling, relaxing. Yes, the energy."

The greeting energy of Maggie's buildings gave the users an uplift and a feel-good factor (Study 8). A female visitor interviewee expressed based on her experience that it was the energy of the building that was healing and enhancing her mood apart from the therapy delivered and socialising (Study 5; p.1):

> *There's a very strong, powerful sense to it, it's not just peaceful, there's real strength, one day … the class had started when I got there, and I opened the door and the energy was palpable… that's partly a group exercising together, but a lot of it is the building.*

A member of staff observed that even the first step from the door made people at ease (Study 11). The importance of the building's atmosphere for being welcoming and relaxing was also stressed in Study 2 by two different interviewees at two different sites. For their first time, both of them entered the centres while there was no one around, and they felt the greeting and warmth from the inviting space. The source of these feelings was not based on greeting from people or therapy from the staff, it was the building's atmosphere. They were still receiving the same energy from the architecture during every visit.

The place gave optimism and confidence to the patients who were often desperate. All the participants in the focus group agreed with these statements, and no negative connection with the centre was associated (Study 11). An art therapist staff of Maggie's West London particularly stressed the calming impact of the centre (Study 3; p.5):

> *The building is an escape for people. They often come in from the hospital between*

blood tests and chemotherapy and it provides a calming space. It's almost as if they can breathe again. You see them visibly relax into the building.

A male cancer patient in Maggie's Dundee also used the building similarly as breathing and relaxing zone just after leaving the hospital (Study 1; p.265):

When I come here, typically it's about getting bad news and sometimes Maggie's is about just allowing time to pass before going home. It's important that this space is very nice. It is a buffer zone because you don't want to take that straight home.

A group of participants defined everything that Maggie's Centres did as solely about its sanctuary and peace (Study 6). This was what the cancer patients needed to handle the stress and anxiety while fighting their illness.

It's like a warm hug, you just come in here and are sort of enveloped in something, like a warmth, magic, warm feeling (Study 5; p.1).

Overall, the participants pointed out how the architecture had energy and an atmosphere that encouraged them to feel relaxed and welcomed. However, a psychologist staff explained that Maggie's Centres still needed some improvement to make people more relaxed to stay in (Study 2; p.6):

You could have a building that is fantastic and really impressive, but actually not a nice place to be in. I think a Maggie's centre still needs to have that closeness and you need to feel held in it. It's not just about doing something really impressive and inspiring, you know. A cathedral can be impressive and inspiring but you might not feel you want to sit there and have an intimate chat with somebody there.

Lastly, one of the important aspects in terms of architectural impact, that made people relaxed and welcomed was the non-intuitional characteristics of the centres (Studies 1, 2, 3, 4, 5, 8, 12). Even though the impact of the non-intuitional feeling of the spaces was highly associated with the personal past, it might affect the people even if they were not much familiar with the hospital environment. The people often described the centres as contrasts of a clinical hospital environment which was referred such as stressful (Study 3), depressing, drab, gloomy and horrific (Study 1), and antisocial (Study 2). People did not feel relaxed and welcomed in usual healthcare settings because they had a "sense of secrets" and "lack of trust" due to strict restrictions on the use of spaces, locked rooms and gardens, hardly or not operable windows etc. All these spatial conditions evoked a feeling of being trapped (Study 12). However, there was no lock or key in Maggie's Centres where the metaphor of a house was used, from the signs to operable windows, from the kitchen tables to natural elements which created a contrasting atmosphere with the nearby cancer hospitals, therefore, people felt welcomed, calm, peace and relaxed along with the feeling of safety (Studies 8, 12).

Figure 5-46: References to the Welcoming-Relaxing spaces, and interrelation with the other codes referred together.

5.2.4.2. Personal Past – Sense of Belonging

One of the dominant reasons for users feeling safe was confirmed to be enabled by experiencing a sense of belonging or associating their own memories from their personal past with the experience of Maggie's spaces. People expressed very frequently that they felt like coming home, and therefore they felt welcome and safe when they entered the centres (Studies 3, 4, 7, 8, 10). An important consideration about why they related Maggie's Centres to home lies in their own perception of what home means, and the notion of family and home culture, which depends on the context in which they grew up. Therefore, unsurprisingly, there was a strong connection between the sense of belonging and feeling welcome and relaxed. In consequence, those responses that referred to a 'homely environment', which also indicated the interviewees' perception of 'home', were included in this code although there was no clear data that confirmed whether their perception was related to their personal past.

Architectural layout and interior design such as the kitchen table or the open-plan with living room-like furniture (Studies 3, 7, 8), daylight exposure (Studies 3, 5) and greenery (Study 3) had a central role in creating a homelike environment for the Maggie's Centres users. Also, the multi-sensory experience had a striking impact to help people to create a connection between their memories and the centres' features as explained in detailed section 5.2.3.4 (Studies 1, 5). Some people described how they remembered their memories such as touching pine cones gave energy to someone due to reminding memory from a holiday on a Greek island (Study 5), or natural daylight, the sliding doors and visual connection with greenery recalled the hometown, Japan, of a visitor (Study 3). Else, linking the centre to a church in terms of the level of spirituality aroused a kind of sense of belonging, because the interviewee had to have a familiarity with the church's spiritual atmosphere to create this connection (Study 2). On the other hand, people stressed how different these centres are from the hospitals they did not want to remember (Studies 1, 4, 7).

Thus, considering personal past experiences, feelings, and memories were clearly identified as significant factors, it was important to make people not only remind them of the positive things in life but also forget these unpleasant and negative memories. In Maggie's Centres, the collective unpleasant memory of visitors was hospitals and clinical environments where they learnt about their illness and regularly visited for treatments while facing death. For this reason, crucial criteria for the architects were focusing on homely environments and nature-based stimulators (Study 4).

Figure 5-47: References to Personal Past-Sense of Belonging, and interrelation with the other codes referred together.

5.2.4.3. Refuge- Feeling Safe

The architects wanted to create a safe environment which was also supported in the Architectural Brief (Maggie's Keswick Jencks Cancer Trust, 2015; Study 2). Hence, the buildings were found safe and private overall, many interviewees expressed their feelings without specifying a reason, such as “when I walk in here, I feel like I’m in my mother’s arms” (Study 9) or “this building is very clever, very clever. It brought me in, I felt very safe, which was important” (Study 2). The visitors who had cancer usually found the centres safe enough to unveil their emotions or to cry privately without being isolated. Thus, the staff stressed the importance of the welcoming and safe atmosphere of the centres where people were getting used to how to use it privately without being isolated (Study 8). A visitor described how she felt safe at the centre (p.4):

> *It’s a bit like coming in to a gigantic womb: coming in and the whole thing sort of enfolds you, like, you know, it’s giving you a great, big hug. And there’s no end to it. No... It’s, must be a word for it: unconditional.*

Some defined the centres as ‘chillout building’ in which the architecture reflected a feeling of containment in every room, so they felt protected (Study 3). Although some interviewees pointed out the buildings as safe places as a whole with all features, some others described some features that encouraged the feeling of safety and created a refuge. As explained in section 5.2.3.1, the application of some architectural forms, layout, kitchen tables, windows and huge or curved walls had an impact on creating refuge and safety.

For example, one felt safe due to the huge barrier between the centre and the hospital, which was perceived as a horror experience (see 5.2.4.2) because that environment reminded her of unpleasant memories. The same patient continued: “This was the only place I could cry. The main thing about this place is you feel safe”. However, another person felt powerful and safe because she likened the centre to a church in terms of spirituality (Study 2). The reason why she found the church sort of level of spirituality was her personal past and sense of belonging.

Once more, light, plants and greenery were frequently mentioned in terms of creating a safe atmosphere. The barrier effect produced by plants was appreciated, however, some people recommended even increasing the plant barrier to feeling safer. A patient emphasised how she was feeling secure and safe in the indoor garden, away from the horrible hospital wards. The trees protected the inside but allowed the chance to get a glimpse from the outside, to have an idea of what was inside. Although some of the staff members pointed out that they did not have enough privacy since it was a workplace for them, all of them said the plants in her centre’s garden shielded them from the visitors’ view, which created privacy both ways (Study 2).

Lastly, the material choice had an impact on the feeling of safety along with the architectural form and furniture. A patient described the concrete parts of the structure of a centre as the provider of enough shelter (Study 2). However, wood was the only material that was associated with feeling safe, and defined as womb-like and comforting (Ibid.) (see 5.2.3.5).

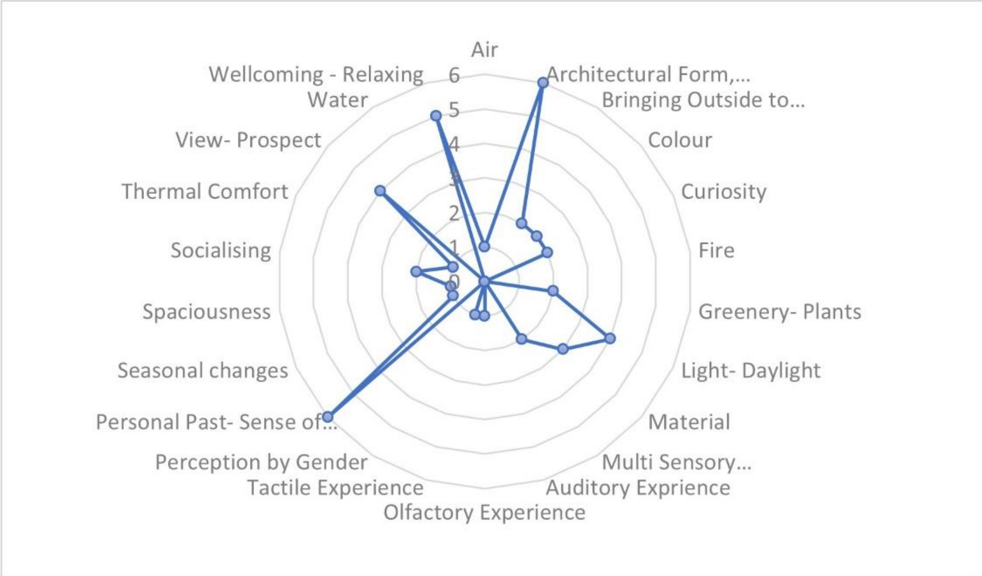


Figure 5-48: References to Refuge-Feeling Safe, and interrelation with the other codes referred together.

5.2.4.4. View- Prospect

Although view and prospect are different notions, both of them have a great portion in common and allowing a view from inside also encouraged the prospect according to the sources examined in this meta-synthesis. Thus, these two notions were taken into account together in this section.

View and Prospect code was highly mentioned together with the Light and the Greenery codes (Figure 5-49). Views were fundamentally provided through windows from which the natural light was also coming in (Studies 1, 2, 3, 4, 7). In terms of connections with greenery, all Maggie's Centres had green elements and a strong bond with the gardens, so the views from the buildings usually had a deep visual perspective of the plants (Studies 1, 3, 4, 9).

As mentioned in section 5.2.4.3, the balance between prospect and refuge was important in Maggie's architecture. For example at Maggie's London, people stated that they easily saw who was coming to the centre wherever they were in the building, which also promoted social interaction (Study 11), while they were away from the foreign eye without being exposed (Studies 1, 3).

Maggie's Centres allowed the users to have visual contact with the outside and within the buildings which supported handling stress and calming down along with the sanctuary-like impact of the refuge features. Therefore, view and prospect helped to create a contrast with the hospital environment around (Study 3) and enhanced the respiting characteristic of the spaces (Study 6).

Viewing out, particularly the greenery of the gardens or blue sky, encouraged the feeling of relaxation and a sense of comfort (Studies 1, 2, 3, 4, 9). A cancer patient visitor stated: “The fully glazed doors and windows allow me to see the greenery outside, and I feel as if I’m in the country” and she emphasised that the centre made her feel good and happy (Study 3). Spacious space with a view from windows reduced the feeling of claustrophobia (Study 1).

Some interviews stressed that viewing the outside life was important because they did not like the feeling of being isolated, although they did not want to remember the feeling of the nearby hospital (Study 1; p.213):

> *It is still attached. I like the fact that you can see lots of things – the road. It is tranquil, especially with the grasses rustling. You can still see life and people and things going on.*

However, visual contact with the outside life was not a widely accepted expectation by all the visitors, some others wanted a fully introspective experience away from the outside world while they were calming down there in silence and with a view of nature, or socialising with the people who had similar problems to share (Studies 4, 12). An interviewee in Study 9 supported not having a visual connection with the surrounding urban area (p.4):

> *I like this one, though. It is very light and airy. The best thing about it is the garden. When I’ve seen photos of this building it looks like it is in an open space, but it is actually surrounded by other buildings but, once you’re inside, you don’t feel it. You see the gardens, rather than the buildings.*

Interviews with architects in Study 4 revealed that all designers wanted to design the centres towards nature as much as possible because, independently from Maggie’s Architectural Brief, their research and experiences had also proved that nature had a therapeutic agency. Therefore, if it was possible in those locations they used the stunning views to create a strong connection with nature (i.e. Dundee, Forth Valley, South Wales). However, even if there were no natural settings in some centres located in more urban areas, contact with nature was a key principle in their design as well, thus, the gardens and views of the sky took the main role in this context.

Figure 5-49: References to View-Prospect, and interrelation with the other codes referred together.

5.2.4.5. Socialising

As explained in 5.2.3.1, socialising was primarily encouraged via architectural layout and some simple furnishing and fitting touches.

Overall, Maggie's Centres provided a variety of private and social interacting spaces (Study 7). Participating in the activities with people who had similar problems and goals, and sharing the same feelings helped the cancer patients to be adjusted to the community, and not feel alone and isolated. One of the main reasons why the cancer patients were visiting the centre was the socialising opportunity (Study 2; p.4): "I'll go over and you feel OK to chat to people because it's just lots of conversations of relaxed things."

Figure 5-50: References to Socialising, and interrelation with the other codes referred together.

5.2.4.6. Curiosity

The quality that triggered curiosity was usually the 'mystery of space', which was considered an essential element of biophilic design (Browning et al., 2014). The mystery was expressed to be given to Maggie's spaces via architectural design, by generating particular spatial experiences (Study 8). The unconventional external architectural forms and non-traditional shapes of these buildings and the materials used in them were the most emphasised stimulation for curiosity or the factor that intrigued people and enticed them to visit the centres. The power of iconic architecture attracted people even if they didn't know anything about Maggie's Centres buildings (Studies 2, 4). Study 4 stated that all participants stressed the fascination and curiosity evoked by surprising architectural form and exposed roof structure. Curiosity was also aroused by offering glimpses inside the centre but not exposing the activities. Sometimes the gardens and trees created this effect for outsiders while providing refuge for visitors. Sometimes the openings of the building attracted some interviewees to inside Maggie's West London (Studies 1, 4).

The responses showed that arousing curiosity not only encouraged the people to step in, but also made them explore the centres and activities within the place (Study 8). The outside-inside connection, for example, made the centre changeable, like a living organism, thus intriguing people to keep exploring the centres, by that time they were getting integrated into the community (Study 2). Curiosity sometimes turned into a shock with a mystery of unexpected features, which was described as a 'disarming effect'. A member of staff explained how helpful it was this 'disarming effect' of architecture for inviting new patients (Study 2; p.6):

> *I think even if it's just sometimes a second or two, you see quite a lot of people forgetting their cancer once they see the building, even if it's just for a few minutes. After coming in they feel safe, and they just get it all.*

Overall, the architectural form was the code that most triggered curiosity among all codes as explained also in 5.2.3.1 (Figure 5-51). The responses obtained in interviews and focus groups in these studies (Studies 2, 4) emphasised the successful architecture of Maggie's centres by combining both familiar and relaxing domestic features that made the people feel safe and homely with surprising and stimulating features which attract people by curiosity.

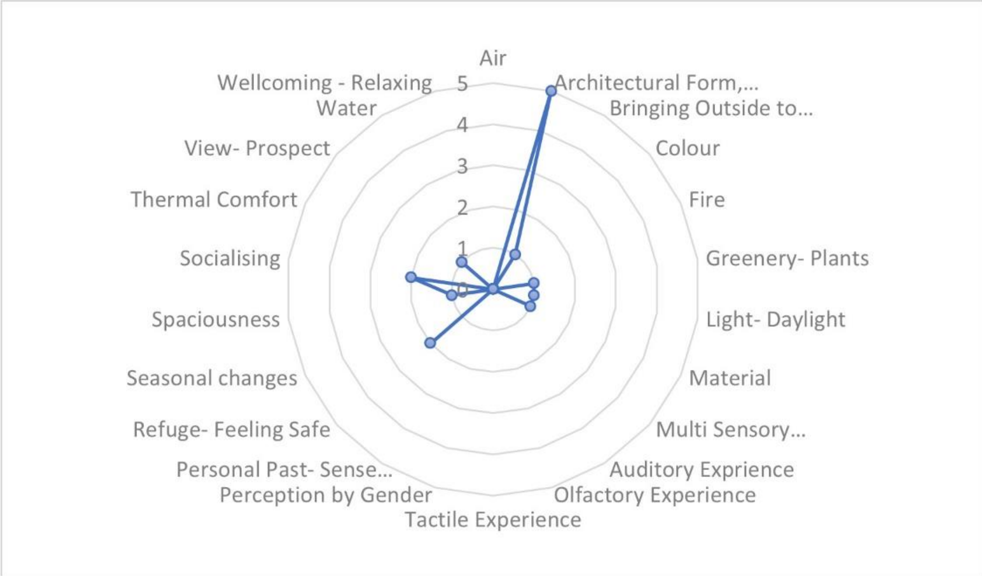


Figure 5-51: References to Curiosity, and interrelation with the other codes referred together.

5.2.4.7. Perception by Gender

The data about perception differences based on gender came mainly from observations from the staff and were scarce. According to responses in the interviews, the most prominent feature of Maggie's Centres that attracted the male visitors' attention in comparison to their female counterparts, was the choice of material (Studies 2, 5, 9). The wooden materials and the high specs of the design of the building were always far more noticed by men and sparked their curiosity (Study 2). A cancer specialist staff explained this in her observation (Study 5; p.1):

> *This building works for men better than I've seen [elsewhere]… they get intrigued by how things, the materials that have been used and things like that, they very quickly offer you an opinion on it… it's a door opener, it's far better than a half-hour preamble about football.*

Furthermore, concrete as a building material was accepted more by male visitors, so the architects of Maggie's Newcastle, who wanted to build a male attractive centre, used fair-faced concrete walls that were juxtaposed with softer timber edges (See 5.2.3.5). Other than the material choice, an outdoor gym located on the rooftop was also added to the design to attract more male visitors. As a result of these interventions, 45 per cent of Maggie's Newcastle's visitors were male, while the male visitors were 34 per cent of the total visitors overall in Maggie's Centres (Study 9).

Figure 5-52: References to Perception by Gender, and interrelation with the other codes referred together.

5.3. Summary of Findings

The contrast of the nice green. It is open plan with that horrendous building next to it. Maggie's that's what it's about. I have heard many people laugh and smile here. It is the contrast. It highlights them even more. My first impression of Maggie's was that it was positive, light, happy, refreshing and I still feel this. I remember the colours and the helpfulness and friendliness. It's the people that make the place. The open space and light (Study 1; p.296).

In the context of cancer care, mental health issues are confirmed to cause a detrimental impact on patients, in particular stress, depression and anxiety regarding how cancer will affect all aspects of their lives. Thus, patients and their families highly value places that mitigate these feelings. It is clearly stated in numerous comments from users in this study (474) the need for a provision of relaxing and welcoming environments. It was confirmed that users found themselves relaxed and welcome when exposed to specific design parameters, being biophilic design critical in the planning of these environments, with two 'umbrella' parameters/codes driving the design decisions: Architectural Form, Layout and Furnishing and Welcoming-Relaxing. Architectural Form, Layout and Furnishing is not *per se* an established Biophilic Design Parameter but agglutinates a number of Biophilic Design Parameters, identified as Interventional codes in this study. Similarly, Welcoming-Relaxing is not an established Biophilic Design Parameter but is fed by other Biophilic Design Parameters, such as Mastery-Control, Affection-Attachment, Attraction-Beauty, Information-Cognition, Reverence-Spirituality or Spirit of Place, as well as other Outcome codes. In this context, it is clear that these two new concepts would be critical parameters in a revised design framework.

According to the results, creating a welcoming and relaxing environment was the most important of all architectural features of the therapeutic environment. Welcoming-Relaxing code was referred to in 71 responses, not only with the interventional codes but also with the outcome codes referred to this code. Whereas Architectural Form, Layout, Furnishing And Fittings were the most effective intervention techniques and the main interventional code. These two codes represented the two basic features of the therapeutic design: the architectural form, layout, furnishing and fittings were the main tool that the designers used for reaching the main aim, a welcoming and relaxing place. Although all the other codes had their specific aims and outcomes, almost all of them either supported them or were supported by them. Thus, these two codes had outstandingly referenced by the interviewees.

The Light-Daylight was the third most referenced code with 38 references. It was followed by Greenery-Plants which had 37 references. Even though there was only one reference difference between them, the light was more important than the greenery. Because both of them had limitations in this review. The light had fewer references than reality because the light was not included in all interview responses in the previous studies by the authors, who did not want to repeat in their studies. Study 12 claimed that all interviewees stated the importance of daylight which was improving their emotional wellbeing. On the other hand, the studies of Angie Butterfield (Studies 1, 5, 6) mainly focused on the gardens, thus, this review had sufficient data in terms of the greenery and plants.

Personal Past and Sense of Belonging had a striking impact on feeling welcomed, relaxed and safe. Thus, it was the second most important Outcome feature for therapeutic environment design. The result showed that representing or adumbrating some trails from the local, vernacular and traditional features was important to arouse mood-lifter feelings.

The codes Multisensory Experience, Refuge-Feeling Safe, View-Prospect, Socialising, and Material were referred in over 20 responses each. Socialising was the only one that was not a biophilic design element. However, the study showed that it was one of the most important characteristics of a therapeutic environment like Maggie’s Centres.

Air was the most underrated code in this study, considering the vital importance of air. As explained in 5.2.3.9, it was likely that the importance of air was widely ignored by the interviewees. However, it could be accepted that the air quality was sufficient in the centres because nobody reported a symptom of the absence of fresh air.

Study 7 summarised the important design features based on her six-month period post-occupancy evaluation in Maggie's Nottingham. She indicated the design of windows which provided sufficient natural light, nature view, and improved inside-outside connection while maintaining privacy. The nonclinical-homely environment, interacting possibility, a range of social and private spaces, the quality and choice of furniture, colourfulness, domestic scale lightings, warm and tactile surface materials and gender neutrality were the other important design features that had wellbeing and performance-related outcomes (Study 7).

Out of all the Biophilic Design Parameters ('patterns') established in current frameworks, the parameters that users found most relevant in this building typology (healthcare/therapeutic programmes) are: Light-Daylight, Greenery-Plants, Natural Colour, Water, Seasonal Changes, Fire, Sensory Stimuli, Spaciousness, Inside-Outside Connection, View, Prospect, Refuge, Personal Past-Sense of Belonging, Feeling Safe, Curiosity-Enticement, Natural Material, and Thermal Comfort. Out of these, Daylight, Air, Greenery-Plants are the most important, while Seasonal Changes, Thermal Comfort, Water, Fire were less relevant parameters. Figure 5-53 illustrates all relevant codes in ranking order and shows the importance level of biophilic design parameters.

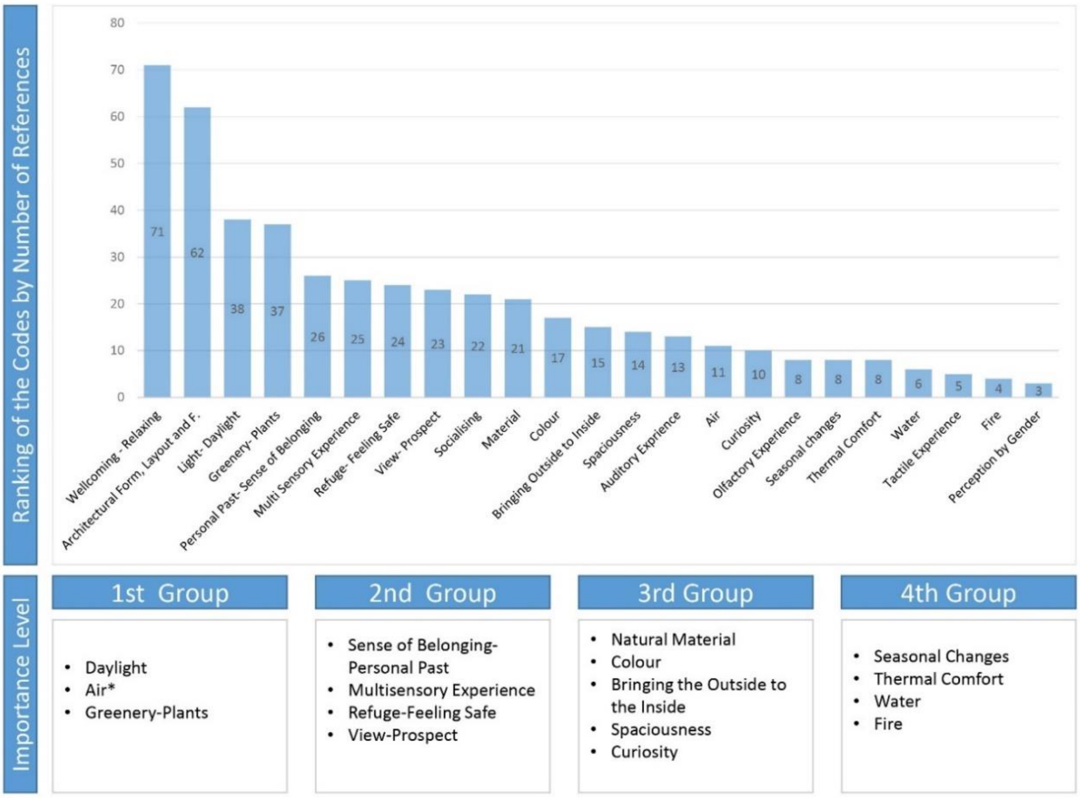


Figure 5-53: Ranking of the codes by number of comments. This figure also shows importance levels of biophilic design parameters (*Although Air should be in the third group based on the results, it is considered 1st level based on the limitation explained in 5.2.3.9)

How the prominence of these parameters is determined, as well as their interactions with other parameters, are in turn driven by two factors in this context. Firstly, for both users and designers, it was crucial to establish a clear difference with standard clinical environments, to avoid any remembrance with the painful experiences associated with the treatments and procedures but also with the environmental discomfort experienced in hospitals in terms of smells, noise, lack of natural light, endless corridors or high temperatures. Secondly, it was also critical not only to avoid the hospital environment but to create spaces that reminded users of safe and pleasant experiences, using references to homely feelings, promoting a sense of belonging and eliciting memories. All biophilic parameters work towards achieving these two factors, and this is done mainly through the two 'umbrella' concepts/parameters explained above.

5.4. Concluding Remarks

Qualitative research is an invaluable method for gaining new insights into inclusive design. This meta-synthesis approach allowed to look deeply inside the efficacy of biophilic design parameters in the non-institutional therapeutic environments from the users' point of view. The main limitation of this study was that the analysed studies did not aim to collect data to specifically test the value of biophilic design, so questions and their corresponding responses were guided by other goals. But equally, they were not affected by the potential bias that can be inadvertently induced through targeted questions. Obtaining primary data from studies with a focus on biophilic design is critical to providing more rigorous results. Still, as the analysed studies provided substantial information about established biophilic parameters, I believe that the extracted conclusions are indeed reliable, and can contribute to the revision of a more accurate framework to guide future design in the area. Another limitation was the fact that the analysed research studies were anonymised for ethical reasons, and in most cases did not include the name of the studied buildings, which led to a lack of clear connection between the participants' comments and specific design features. Therefore, the assessment of some characteristics was done by contrasting these comments with the design of Maggie's buildings in a general way.

The data obtained in this chapter and the previous chapter (Chapters 4 and 5) were supported and crosschecked by the primary data in the following chapter. Chapter 6 reports and analyses semi-structured interviews carried out with professionals and experts.

CHAPTER 6

6. EXPERIENCE AND PRACTICE OF THERAPEUTIC ENVIRONMENTS

This chapter examines the interviews carried out with experts and practitioners in therapeutic environments design. These interviews aimed to provide a means to contrast the results obtained from the systematically searched review and meta-synthesis studies presented in Chapters 4 and 5 by crosschecking data obtained from a primary source, as well as to complement the input to the final conceptual framework based on recommendations offered by experts and practitioners.

6.1. Semi-Structured Interview Methodology

Semi-structured interviews are a useful tool for exploratory and explanatory studies as they can allow to infer causal relationships between variables (Cooper et al., 2008). This sort of interview approach can be the most advantageous in research where there are a large number of questions to be answered, the questions are either complex or open-ended or the order and logic of questioning may need to be varied (Easterby-Smith et al., 2012; Saunders et al., 2009). The semi-structured interview approach serves to understand the reasons for the decisions your research participants have made, or the reasons for their views and opinions (Saunders et al., 2009), and also gives an opportunity of probing the answers of interviewees who may be asked to explain or build on their ideas and allow to investigate the meanings of words or ideas that will add value and depth to the data collected. Moreover, this approach can lead the conversation in directions that had not been considered before but emerge as important parts to address the research question and objectives (Ibid.). Due to the above-explained opportunities, the purpose of this research and the nature of the data collection questions, it was decided that semi-structured interviews should be employed in this PhD study. It is paramount for this process to be rigorous and the interviews conducted as objectively as possible because the semi-structured interview method entails a risk of bias, subjectivity, reactivity and inaccuracy (Saunders et al., 2009).

The interview population consisted of therapeutic environment experts and practitioners in the fields of psychology and architecture. Lesley Howells, psychologist and research lead of the Maggie's Centres Research Advisory Group, agreed to be interviewed as an expert on these special therapeutic environments. Additionally, architects of some of the Maggie's Centres, who were also knowledgeable and involved in the design of clinical settings, were invited to be interviewed. Five architects (Darron Haylock from Foster+Partners, Eoin O'dwyer from A_LA, Piers Gough from CZWG, Lucy Brittain from Cullinan Studio, and Ivan Harbour from Rogers Stirk Harbor + Partners) participated in these interviews, which took place between March 2021 and February 2022. The meetings were performed remotely via video call due to the COVID-19 restrictions, where the mean session duration was 45 minutes. The research reached saturation with five architects, as the centres to be discussed in the interviews covered the whole range of design situations: urban and rural context; ambitious and modest approaches; use of a variety of materials; implementation of gender-focused strategies; and the selection also considered the inclusion of early period and recently designed centres.

The questions designed for the architects were focused on generic design decisions, to start conversations that sought open answers in specific. These included issues such as assessment of their awareness of the biophilic design theory; Maggie’s Architecture and Landscape Brief and its importance in the process; the effectiveness of communication and management with the client; the design process and steps that were unusual; design intentions, specifically in connection with considerations of the human-nature relationship in the spaces; the main design aspects or drivers behind the project; their background research and required consultant fields; their approach to site analysis/context in the project; their design considerations in relation to biophilic design parameters; the success of the buildings based on post-occupancy feedbacks and detected drawbacks; and environmental features that provided a healthy environment for patients and staff. In terms of clinical environment design, questions were focused on the creation of the best connection with nature in clinical settings, and the differences between the clinical and non-clinical (Maggie's) environment design processes.

The interview questions for the research lead from Maggie’s Centre Research Advisory team mainly focused on the impact of the environment on users based on her and other staff observations. The general theme of the question design included: the most successful elements in the buildings in terms of first impressions and the buildings’ impact on users; observed differences between in-centre therapy and remote therapy during the COVID-19 restrictions; qualities of the space that are considered when allocating the different activities or parts of the programme in the different spaces of the centre; functional qualities of the buildings that staff can appreciate and visitors don't get to appreciate; the success of Maggie’s Architecture and Landscape Brief in connection to nature in the buildings; visitor profile based on gender differences; and the impact of biophilic design parameters and seasonal differences.

All interviews were recorded and transcribed verbatim. The transcripts were imported to NVivo 12 software for analysis, then coded and organised into exclusive and exhaustive categories to discover overarching themes, which are examined in the following sections.

6.2. Non-Clinical Therapeutic Environment Design in Practice: Maggie's Centres Example

This section reports the interview themes relevant to Maggie's Centres, which were undertaken as a central case study for therapeutic environments. The research departed from the hypothesis that Maggie's Centres' could offer a relevant example of non-clinical biophilic design and that the information obtained from Maggie's Centres' design process, design decisions, and application of biophilic design parameters could inspire and guide clinical biophilic design environments, although clinical environments have more strict and complex procedures and programme.

6.2.1. Design Process and Decisions

The studies in Chapter 5 and post-occupancy reports showed that Maggie's Centres' environments were successful to mitigate mental and emotional health problems. Therefore, understanding the design process and design decisions can guide architects when designing therapeutic environments. So that the interviewed architects' opinions and their advice reported in this section will inform the preparation and design process of non-clinical settings as well as clinical settings.

6.2.1.1. Approach to Maggie's Architecture and Landscape Brief

Maggie's Architecture and Landscape Brief was extremely appreciated by all participants as a guideline that describes all requirements of the programme and demanded environmental features in a way that does not limit the imagination of architects and encourages them to design uniquely. Brittain highlighted the emotional and human-centred descriptions in the brief:

> *Maggie's brief is very open and imaginative and considers how people feel in the building rather than specific space requirements. For example, they ask for a toilet that someone can use with space for a short break or a cry if needed… In Maggie's brief, visitors are encouraged to feel at home in the space and invited to make themselves a drink in the kitchen. There is a choice of places to sit, to either be engaged with people or places of refuge for quiet or to observe activities within the building.*

Moreover, the non-descriptive language of the brief that explains the required atmosphere was emphasised by Harbour:

The lovely thing about the brief, as I was talking about how good the brief was… It wasn't prescriptive. It just set a scene, we can then interpret it as architects. I think there was an aspect of that, which was about the sense of home… Beyond that, I think there was nothing as developed as the brief exists today, with our immediate connection with the environment around us and to the outside world, to nature. But it was sort of implied.

O’dwyer described the brief as incredibly focused on the building, but also on nature and the relationship with natural elements. It encourages to move away from the typical clinical hospital environment. The brief pictures a place “like a kind of oasis in the hospital complex that cancer patients and their families or friends can go and get benefit from a peaceful environment which is the exact opposite to a clinical environment that can be quite distressing and busy. Also, you're not always in the best state when you're getting treatment”.

Maggie’s brief supported and encouraged them to create a strong connection with nature, promoting privacy, site and landscape decisions with a highly established portfolio. Although it was tricky and challenging to apply nature connection and create the required atmosphere in the landscape of Maggie’s Southampton, the team made an effort to follow the brief’s descriptions. Moreover, O’dwyer highlighted that every Maggie’s building is quite different and has unique approaches to considering the brief but all have the same relieving impact and strong connection with nature thanks to the brief:

One of the first things that we were keen on, was to visit some of the older centres, so we went to the centres in Hammersmith… in Cardiff… in Glasgow and a couple more... And we understand that the relationship with nature is very strong in all centres. They all have very different challenges. Every site is completely different… Every architect has a solution to the brief quite differently. For instance, Maggie’s West London has this red wall that wraps around and shields it from a quite busy road that goes next to that. We didn't have to have quite such a shielding device for our project. But we liked the idea of shielding the site from the car park. So we use the trees to do something similar [shield] but it was less built up.

6.2.1.2. Preparation to Design

Prior to engaging in the design process, all interviewees preferred to visit existing Maggie’s Centres to observe how the buildings worked with users, and how the brief's requirements were implemented in the design. As Gough stated, visiting sites is an ‘architect’ way of research: “I think architects learn from other architects, buildings”. Qualifying this, the brief was not descriptive of the building in detail, so visiting and observing existing buildings was critical:

> *I approached the guidelines by visiting a number of other Maggie's. And the point is that most architects they [Maggie’s] employ, get more or less the same brief which is quite prosaic. It's quite factual and doesn't particularly tell you what to do. And they [client] love the fact that each architect interprets it in their own way, and they're [client] very generous to different architectural interpretations. As we see no two Maggie's are the same or even many of them are quite different on different spectrums. Some are very much involved with the landscape and the surroundings, and some are on quite austere landscapes.… I just went around and had a look at them, and then just formulated my own way of doing it. So, my brief to myself was to try and do something more economic.*

The architects of more recently designed centres had a large variety of occupied centres to visit and learn from, as 24 centres are in use today (20.03.2022), whereas for the first centres this design process did not include this opportunity, and architects had mostly the brief and the clients’ opinions. Therefore, our interview with Ivan Harbour, architect of Maggie’s West London, which is England’s first centre, shed light on the design process of early centres. He visited Maggie’s Centres in Scotland but Maggie’s Dundee, the first purpose-build Maggie’s Centre, was not occupied yet and Maggie’s Fife was under construction:

> *I went to Maggie's in Edinburgh and just sat there in the space. What I was interested in was not necessarily the architecture. I just wanted to know what the ambience was, how did the day work, and how did they operate the centre? And… how did people use it? That's what I was trying to understand there.*

However, Maggie’s Edinburgh was not a purpose-built centre, therefore, the way of learning from the building was restricted:

> *So the approach to the design process meant us talking to the client more frequently during the process of conception. It was actually rather interesting, because they were a very good client, and they were very prepared to listen and give us space to work. Their commentary on the design was made in a way that they would point to sort of pragmatics things rather than expressing opinions over global sort of realisation and thinking of the idea. [This pragmatic approach] is*

actually very important, because the best architecture is essentially about sending a whole set of compromises that, in the end, work and don't feel like a compromise. I think that approach, which says they point to the pragmatics of things, is a way of just saying go away and think about something and let's see what happens, let's see if it evolves in a particular way. And it did, to be honest. So when we started, its conceptual plan was much more striking. But probably had a certain amount of impracticality about it, which would have come out further on down the line in any event. But certainly, it is also because of working with Laura Lee and Marcia Blakenham and, of course in those days, Charles [Jencks], we did design workshops. It was a good way of evolving and making the thing seem simpler, [but] it takes a long time to do a simple thing… It took a long time to evolve as well, that sort of process.

Harbour stated that the success of their design comes from the amount of brainpower and architectural thinking with knowledgeable and conscious clients. Although Maggie's Centre was a quite small project the architectural team had to put in a lot of effort. He compared their effort in this project with the Madrid–Barajas Airport project that he was working on at the same time as the Maggie's Centre. The 1.2 million square meters of construction of the Madrid–Barajas Airport and the 300 square meters of construction of Maggie's West London almost ran together.

6.2.1.3. Communication with the Client

Moreover, the attitude of the client also supported the creativity of the architects within the frame of general spatial requirements. Haylock and O'dwyer appreciated Maggie's team as experienced clients who were involved in every step, and coordinated and communicated with the designers at all times, O'dwyer explained his experience:

I think there was always an understanding. Maggie's [client team] are very open and willing to listen to the architect's advice or ideas. And they have very particular elements that go into a building, but they're always very open to having a conversation with the architect to give them their thoughts… They also want to not restrain the creative ideas of the architects, which is a really refreshing approach to working with a client...

Communication with the client team was very important for the architects as the brief does not elaborate on every detail of the building. The client team, consisting of Laura Lee and Marcia Blakenham, as Brittain explains, was an experienced team who had full knowledge of Maggie's needs, and therefore it was highly beneficial to work with them:

> *For the original project, the client team consisted of Laura Lee, Maggie's original nurse, and Maggie's friend Marcia Blakenham. Therefore, there was a very strong connection with Maggie's original intentions and ideas. They were very open to us interpreting the brief as we thought best, and open to architectural ideas.*

The interviews supported the following premise posed in Chapter 4: *decision-makers, designers, management, and administration should have knowledge about the importance of nature engagement to sort the barriers* (See 4.5.3). The buildings are so successful not only because the designers were experts in their job, but also the clients. Gough confirmed this aspect of the clients in his observation:

> *You really wish to have all jobs like that [because] the client was so experienced. They built quite a few Maggie's Centres. They are always attentive to your ideas rather than imposing their ideas. They are fascinated by how every architect does something different. That's inspiring… You are trusted [by client], very much trusted, and you are almost pushed to be as honest as you want to be, and do anything you want to do.*

6.2.1.4. Setting up Design Drivers

As stated above, architects usually tend to learn by visiting sites and buildings, in a traditional way. Brittain said: "We always start with understanding the site and meeting the client. We visited other Maggie's Centres beforehand to understand how the brief was delivered in other Maggie's Centres." She also stated that they also discussed with the users of existing centres to decide on the design drivers. Besides, doing research at the beginning of the projects or consulting specialist consultants were also common approaches that they follow during the process. Haylock explained their approach to starting the design for both Maggie's Centre and other projects for clinical settings they had done:

> *We speak to as many people as possible, we speak to specialist consultants, and we also do our research and formal analysis. Very often you will find something that you think you will establish a very strong design driver…. So, it's important to do the research. And from that research, then it'll become a design driver.*

Harbour clarified that they collaborate with young architects who do actual research in the office to develop their system of searching and developing design drivers. According to his point of view, the experience and ideas of many people make a design driver more successful. With this in mind, the design team listen to each other's ideas by brainstorming and absorbing all imagery and ideas (including the ideas they do not like). He claimed that to be successful in this approach "what you need to be as naive as you can,…, an educated sort of naivete, you need to be open-minded."

6.2.1.5. Working with Consultants and Experts

Also, consulting the experts about the user group was relevant to support their design ideas. As the main user group in Maggie's Centres are cancer patients, Brittain explained their research method, which also looked outside Maggie's Centres:

> *We discussed the project with the oncology department and key stakeholders in the hospital, held a community consultation event and discussed the successful principles of other Maggie's Centres with the existing users.*

The interviews revealed that all architecture offices preferred to consult experts and consultants. This was not only for the usual typical collaboration with consultants such as structural engineers, mechanical engineers, or electrical engineers, but also, they were aware of designing Maggie's Centres being more of a responsibility because of being charity and its reputation. For example, in Maggie's West London, after designing the centre the architecture office required a garden designer, Dan Pearson, in order to strengthen their design's indoor-outdoor connection and reduce the impact of the noisy and busy urban characteristics of the site with the help of landscape design. In Maggie's Southampton, landscape designer Sarah Price helped to revive spirit of The New Forest, one of the largest forests in southern England located west of Southampton, in the centre's garden, and ceramic experts from Spain were involved in all steps of the project since the main material was ceramic. O'dwyer said: "The project was a lot of collaboration with lots of different specialists." Gough collaborated with Paul Smith, a renowned fashion designer, to enhance the homely feeling with furniture and interior design, as well as the colour selection of interior spaces of the centre. Once again, Cullinan studio also collaborated with Sarah Price and a lighting expert:

> *We used simple passive design solutions, so didn't get into specialist technologies in this scheme. We worked with Sarah Price who is an expert horticulturist to design a rich, layered planting design that would have interest and structure throughout the*

year. Also, there was a lighting designer who helped create a calm internal environment.

Although it was stated by Gough that experienced architects do not usually seek to get consultation or site visits to design all kinds of buildings (e.g. shopping malls in his case), all architects who designed *healthcare settings* (particularly clinical) stated that they worked with specialists to be sure they have done the right arrangements in different rooms, and create a healthier and safe environment.

6.2.1.6. Budget

Interestingly, the strategy and consideration of the finances of the designs were not the same for everybody because the client team did not want to restrict designers with a budget, as they wanted to offer the best architecture possible. However, one of the design drivers for Gough was being economic:

> *My brief to myself was to try and do something more economic. I thought a lot of the architects are becoming quite indulgent, and spending too much money, which is charity money. So, I tried to do a more compact building… Therefore, I was quite happy to have quite an economic exterior elevation. And they [client team] said to me "no, no, no, you have to do something more rich and expensive. You are famous for coloured buildings. How do you want to do that?" So, I suppose ceramics is the only safe way to do really good-coloured buildings. And they said, "Well, you have to do ceramics because we want you to do what you are the best at." … As a client, they were very receptive but also gave you a nice push to do even better than you perhaps had imagined doing. It was wonderful. I mean, they were just the best.*

Therefore, although the architects did not charge anything the budget of the client was also encouraging parameters to design a successful environment as not being restricted economically gave designers flexibility and the opportunity to implement all they wanted. But Harbour said that the process took a long time because the client needed to know what it was going to cost and the Maggie's as being a charity can raise the money for it. The important thing about that was the design should be properly priced and designed before it went out to tender, and needed to be completed on a decided budget.

6.2.1.7. Site Decisions

Although the sites were usually selected by the hospital administration or the client, the architects aimed to approach the sites to maximise contact with nature and offer a sense of enclosure from the hospital environment. Haylock explained their interventions and decisions on the site that enhanced the quality of the design and connection with natural elements:

The reason why we selected the site is that it was at the end of this green boulevard because the journey from the hospital to the Centre is also important. So, you don't walk across car parks. Around the corner, you walk down quite a nice avenue to the site… at the end of the avenue, you arrive at the heart of the project. We were creating a sense of the landscape, a sense of enclosure, and a definition of place, but also thinking about how the sun will move around the site, and where will we locate the gardens to maximize the sun.

According to O'dwyer, they decided to bring a piece of the garden by transferring the idea from a local forest, The New Forest, into the midst of the concrete landscape within the hospital environment because the site of Maggie's Southampton is in an "incredibly sprawling complex of buildings" and surrounded by a "sea of car parks". Their approach to the site was to create an oasis: "The challenge towards us was to bring Maggie's design into this harsh environment that provides the relationships in nature and a kind of oasis in this kind of urban and built environment." Another device that they used, to enforce a sense of privacy within space by lowering the ground level of the site. After bringing The New Forest's spirit, the building now would be surrounded by trees and vegetation, but there will be still a visual connection between the centre and the cars surrounding and some of the hospital buildings. Thus, the designers decided to play with the topography of the site to support a visual contact with nature (Figure 6-1):

What we thought here is if we lower the site, and use that [excavated] earth to create a mountain-like barrier around the site, with this you are forcing that sense of enclosure. So when you are in the building, as you are slightly lower than the cars around in the trees, your eye line becomes more into the canopy of the trees and vegetation.

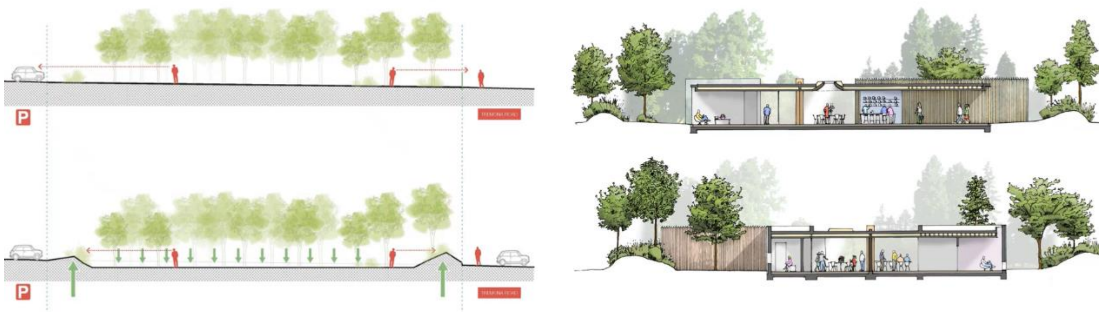


Figure 6-1: Lowering the ground level of the site in Maggie's Southampton.

The site of Maggie's West London had the problem of being in a busy urban environment as well, so the solution was sought with landscape design: to create a nature-supported escape and enclosed building from the outside environment. Harbour explained his perception of the site in the following way:

> *I think the very interesting thing, from my point of view, is that the site was a location that was well known to me. I mean, our office was five minutes walk away from the place. So, I knew the site very well. And, I also knew that the site was on a rather awful road, which was one of London's worst roads because it connects two major arteries that come into London. It is always a bad road. Certainly, the centre needed to be something quite as remarkable. But also, the fact that it was such a hostile corner, we should be able to effectively create its own foreground and its own space. So it was not fighting with that hostile environment around it… It picks up first of all, really the only significant piece of nature along the street, which is the row of London plates*.

Brittain said that their site was an "unloved" corner in the car park at the back of the hospital. So their key goal was to connect the spaces within the building as closely as possible with the outside space and to provide a green outlook, which is psychologically separated from the hospital setting. They considered natural passive design principles in terms of layout and orientation in a fixed position restricted site with activities and building works all around.

Unlike other architects' sites, Maggie's Nottingham's site was in a woodland kind of environment. Therefore Gough decided to elevate the building up to create a visual connection with the green leaves and brunches of the trees rather than the plain trunks.

> *[In the site] green space was considered very good. And many Maggie's have gardens. We are lucky enough to have trees beyond the site, either on the site or just around the site. This site was chosen for its trees. Because the trees were quite beautiful, and also it seemed unlikely that the hospital would want to use this site. That was part of the consideration because we did not want to get in the way of hospital expansions or new hospital buildings. We wanted to choose the site that was almost unbuildable for a hospital, no use to them. Therefore, this very treed site was an ideal combination, although it was quite hilly, it is quite steep… The main idea of the Maggie's was to put perch the building up in the tree canopy rather than down where the tree trunks are. You are kind of up with the branches. Then, we have outside balconies coming out of that space. So, you are not just looking at the*

trees, but can almost shake hands with a tree because the branches are coming over onto the balcony, and you can sort of feel you are in them. We felt this was a very magical and marvellous kind of environment to put a Maggie's, which was existing, we did not have to wait for the plants to grow. It was kind of ready to go. It was like an instant bit of environmental green gorgeousness.

6.2.1.8. Male-Friendly Approach

Another important issue for Maggie’s Centres is gender differences in their user population, as approximately two-thirds of the visitors are female. Lesley Howells explained that the reason is not related to Maggie’s Centres: “that is because of how men use healthcare, generally. So, you probably find the same sort of figures in terms of the use of GPs or other support services…. it's not unique to Maggie's at all. And having said that, it's always our target [to reach equal numbers].” Cullinan Studio prioritised this situation and aimed to design a male-friendly centre:

In discussions with current patients of other Maggie’s Centres, Ted recognised that men are often less keen about using these kinds of facilities to meet and talk about their feelings and issues. He designed the facility to allow opportunities for relaxed interaction, such as gardening or having a BBQ in the courtyard, to help facilitate informal interactions and discussions amongst users of the facility (Brittain).

Brittain also claimed that their design intentions worked, and men are visiting more than other centres. Although the studies in Chapter 5 explored that material and construction details have contributed in relation to encouraging and attracting men to the centre, Howell claimed that the programme and activities have a significant role in this improvement:

That could equally be because of the way that relationships that the centre head built. So I do not think there are any buildings, which are too feminine, to be honest. Not at all.

6.2.2. Biophilic Design Parameters

Although all biophilic design parameters were not specifically discussed in the interviews by the interviewees, the most outstanding parameters were explained and refereed in the course of the conversations. This section indicates the application and perceived impact of these parameters.

6.2.2.1. Greenery-Landscape

Gardens, plants and the connection between building and landscape were one of the most outstanding aspects of Maggie's Centres design. All architects worked towards creating a strong connection with greenery and plants through different approaches.

In Maggie's Manchester, along with the garden itself, a glass house concept was integrated into the centre that became a distinctive characteristic of the centre where the users enjoyed various vegetation in the four seasons and a multisensory environment that allowed users to be involved in activities such as growing plants. Haylock explained their glass house concept (

Figure 6-2):

> *I would say the Glass House at the end of the building is totally unique to Maggie's Manchester. That was effectively a greenhouse because they do grow tomatoes in there like a traditional greenhouse. But its base is to extend those months where you can sit outside and be surrounded by greenery. It is a beautiful space when you are in there. It is just like the pillars of greenery and lushness and smells and a different environment. Maybe in the summer, slightly hotter than outside. But in the winter, it's slightly warmer, again, than the outside. So, you have this kind of freshness. Also, it is beautifully ventilated. It's super successful. So, the glass house is really a focus for the Centre, and I use that for many different purposes. Whether it is writing classes, or just consultations or reflection. They love it. It has a really well view… but also, it helps with the healing as well in terms of the fresh products, and the flowers. The flowers are grown in the garden and then brought into the building. So, there are many different levels of using biophilic aspects to benefit and improve the well-being of the occupants.*

Figure 6-2: The glass house (Copyright Nigel Young / Foster + Partners).

As explained above in 6.2.1.7, in Maggie's Southampton, the way to increase visual connection with greenery was by lowering the ground level of the site. Also, an organic fabric of the local forest was adapted in the garden. O'dwyer said: "One of the inspirations is the New Forest, the local Flora and topography in a wild landscape, it's quite old, it makes you feel very good. You do not have to go very far from the road to feel like you are in a completely different world when you go in there. So, this is the idea that defines creating a protective landscape around the building or the human environment." Thus, the architect team also aimed to create a natural refuge with landscape and vegetation by protecting users from the sight outside.

In Maggie's Newcastle, they aimed to separate the centre from the hospital setting psychologically and visually by providing a green outlook and mounded landscape. In conjunction with Maggie's Nottingham, where Gough created a strong visual connection with trees by lifting the centre from ground level and designing a garden and landscape around the building where the people can become involved with the planting of and the maintenance of the garden (Figure 6-3). He also warned that contact with nature, particularly the plants, should be in balance as nature is not beneficial every time based on his experience and knowledge:

> *In fact, there is research that people in the hospital who have a view of a tree recover more quickly than people without a view of a tree. So, there are definite good outcomes to nature. And the only problem with nature is that it has its time of the year when it dies. When autumn turns to winter, some people find it quite depressing. That time of the year brings out certain problems for people. So, if you make your building predicated on dying plants, then maybe people will die inside. So, you have to be a little bit careful with this notion that nature is wholly good. There's a very interesting study of people who emigrated to Australia from Britain and spent their time at home, particularly wives. Husbands, in the olden days, meant to work and the wife stayed at home. They could not understand why so many wives were so depressed. What they worked out was that the Australian trees shed their leaves all the time, they don't have seasons. They have various indigenous trees in Australia that drop their leaves all the time. This dropping of leaves was what brought about a kind of autumnal depression, which was sort of permanent, instead of just being in the autumn, [the depression] was all year round. Absolutely fascinating, and that is sort of unexpected. The relationship between nature and people's feelings is definitely something to be looked at. So, there may be people who find too much of that. Too much of falling leaves might mean a bad time of year for feeling great about the world. But on balance, I am sure that it was*

the right decision to put [the centre] in this environment because it was so mature. And I think that is very comforting.

Figure 6-3: Maggie's Nottingham.

6.2.2.2. Natural Material

Material choice was another important parameter for the architects to strengthen the relaxing feeling coming from a connection with nature. Maggie's Manchester's structure was constructed with timber, and the material defined the space with triangulated geometrical grids in which they were very keen to be sure that there was no visible metal fixing by using secret straps. Haylock stated that timber as the main material choice was mainly to encourage a biophilic feeling (Figure 6-4):

The idea of using timber as a lightweight material, having that biophilic feeling was something that we borrowed from some early designs which was an aircraft hangar. How timber is used effectively, in a lightweight way, to create a light and airy structure.

Figure 6-4: Timber structure in Maggie's Manchester.

Ceramics was chosen by both Gough and O'dwyer. It was used for the external cladding in Maggie's Nottingham, and as the main construction material in Maggie's Southampton.

O'dwyer highlighted three of their material choices, in particular, that also encouraged and enhanced nature in space and the perception of contact with nature in Maggie's Southampton. Ceramic blocks were used in the construction of the walls instead of concrete. The earthy feeling of the ceramic facade was to feed a biophilic impact on the users:

> *The ceramic walls were quite rigid. But it worked really well against this very natural landscape. You have this kind of juxtaposition where you have a very strong form and a natural landscape working together. I think the choice of materials helps that. Also, you have got a reflective glaze on the ceramic, so it is flexible, a green landscape, but then you also have the earthy tones of terracotta clay.*

In contrast to the main ceramic walls, the external privacy rooms and boxes were constructed of treated wood and enveloped with a stainless-steel topping that reflects and visually expands the greenery:

> *It was quite a conscious decision to do it [polished stainless-steel envelope]. It's quite reflective, quite mirrored. They almost dematerialized. They disappear into that landscape. What we really see when we are looking at this view is a quite striking architectural ceramic wall, then you have this amazing organic landscape around it. And you almost have to look twice to see the privacy box behind it. Actually, they [visitors] do not see a bit of the building. It is quite traumatic* (Figure 6-5a).

With this in mind, the design team decided to ripple the surface to not mirror perfectly:

> *Polished stainless steel, the manufacturer added a ripple to the stainless steel. The reason we quite liked having a ripple in it was that when you are standing in front of it, you do not get a perfect reflection of yourself. Because we thought that it might be a bit strange. It [ripple] breaks up the reflection and diffuses a bit, and you get this lovely, kind of watery, rippled effect of the landscape that is going to soften the reflection a bit. Because we certainly did look at the idea of having a perfect mirror panel. But actually, when you think about it, if you are walking into a building and you are feeling anyway exposed or delicate, even if you have been diagnosed and you are not feeling great, do you really want to look at a perfect mirror image of yourself when you are walking into that building? We weren't so sure. So we had a lot of conversations about diffusing it a bit and breaking up the reflections. However, even when you stand back, you still get this amazing reflection of the lights of the landscape, from these elements.*

Thirdly, they adapted the idea of reflecting daylight and view from outside to floor surfaces. Therefore, polished concrete was preferred (Figure 6-5b):

You might get on an industrial floor. But the reason we liked it [polished concrete floor] was the idea of having a uniform material that linked all the spaces together. But also, we wanted something that was quite reflective. It was perfect for the reflectivity off the floors. It is quite stunning at times. This idea of having this polished concrete floor, without the walls very strong elements dividing the space up, but what links the spaces together is this uniform floor. But also, actually has an almost subservient ceiling. It is just a very plain white plaster ceiling, all the spaces are then linked by the floor finishing, and in the ceiling. When you are in the centre of space you see these reflections. Some days, we get lovely pink, green, and natural colours coming in from the garden. Even the light, you get reflecting from the centre brightens up the space.

Figure 6-5: Maggie's Southampton a) the reflective stainless-steel surface behind the ceramic wall, b) polished concrete floor.

In Maggie's West London, concrete was the main construction material. Harbour said: "The idea of just concrete floors, concrete ceiling, all those things very tough. So, we wanted to display the softer things, the furniture and all of the rugs. We felt it was better to have this quite raw, also not ostentatious." The use of concrete was also preferred in Maggie's Newcastle, where attracting more men was the design driver. However, the concrete was softened with timber. Brittain explained what underpinned their material choice and sustainability concerns:

We wanted to have a building surrounded by landscape earth mounds, so needed a material that would work in this environment. We chose concrete to allow thermal mass and a robust fair-faced finish for the interior. We used GGBS (Ground Granulated Blast-Furnace Slag) to replace some of the cement to reduce the carbon, which also created a light-coloured concrete that provides a calm, cool internal *finish. Externally corten steel was used as low maintenance and robust finish, and provided a good backdrop for the green landscape. The green roof provided additional outdoor space and helped with water retention on site.*

6.2.2.3. Views

In terms of providing a view of nature, the architects maximised the natural elements outside the building by designing gardens and landscapes to provide a direct view of natural elements through windows. Brittain, Gough, Haylock and O'dwyer claimed that they aimed to create a strong visual connection with the greenery on the site. Gough used a view of existing trees, while others produced their vegetation and landscape as the sites were located in a densely built environment. O'dwyer said that they used very big windows to have big views where they created a hilly landscape to replace the visual connection with car park to vegetation (Figure 6-6a). Also reflecting feature of stainless steel increased and deepen visual perception of greenery (Figure 6-6b):

You have a nice, generous light above the centre, and big windows. You are always reminded of being close to the landscape, even when you are in the heart of the building.

Figure 6-6: Maggie's Southampton a) expending nature perception with stainless steel, b) big windows.

Also, a view of water increases the quality of space. Howells described her observation and experience in relation to the view in Maggie's Forth Valley where the site is located beside a loch. As a dynamic feature, the view of water offers a variety of views depending on the weather conditions and the time of day:

Perhaps these times socially distance from the person that I was speaking with, but [without the pandemic] I would be sitting on the sofa behind, both of us would be able to look out on the loch, whenever things get too much, you can take a break, you can pause by looking in a particular direction. So that could be looking out the *way into the beauty of whatever is out there [in the loch], or it could be looking up and seeing a dove up there… Looking out on a loch that has birds flying over it, you can see the changes of the light on the loch and the changes in the sky and the swans coming in. The coots are playing in front of you, coots are another kind of bird… So there is always somewhere you can just pause and let your mind settle and recalibrate yourself before you go on to the next thing… I could go and just sit and look at the loch, or go to another part of the centre, just sit and have the phone call whilst looking on onto the loch. For me, that is simultaneous therapy. But it also helps my well-being to know that I am enabling other people every day so that they can come in and see me but in a space that is really conducive to their well-being… There is a kind of office space. As a member of staff, when you are sitting at one of the chairs, if you just literally turn your head, you have got a view right over the loch again. The way that things are positioned, you can still see the loch. It just takes you by surprise as well, it is just full of lovely surprises that break the moment. You can be stressed out by something in your day, you walk around the corridor and see this beautiful reflection, or you see a view that you weren't expecting to see. And that just breaks the moment and then brings a smile, really.*

Figure 6-7: Maggie's Forth Valley.

Howells claimed that one of the most important environmental features is water. As Maggie's Forth Valley was next to a loch, apart from the view and multisensory environment, the reflected light from the loch surface gives life to the building, and created a changing atmosphere experience in the centre:

If it is a sunny day, you end up with the reflection of the water cast into the centre. You can see the water or the ripples of the water, or the change of the light of the water playing out on one of the walls, in the interior walls. How lovely is that! I can walk around the corner, not looking towards the loch, I am looking into the internal wall, but I have got a kind of light playing on it. So I can just see the movement *something that is outside. I do not know whether it was by design, but it is beautiful. It really is. There is life in this movement. And there is a sense of surprise. But in a good way. That is why when you walk in, you do not have to do something extra special, you just have some things which are a lovely surprise. The water playing on that wall, or the reflection, it is a surprise.*

6.2.2.4. Light

Light was another important biophilic design parameter, the architects referred frequently to their consideration of daylight in the design and its benefits for health and wellbeing. The designs commonly employed big windows, skylights, reflective materials, and glass surfaces to expose more daylight. Although a balance between light and shadow was aimed, the architects tend to increase openings considering the typically cloudy and rainy weather conditions of the UK. In Maggie's Manchester, the aim of the glass house was also to get higher daylight exposure and offer nature-related activities on rainy and cold days. The skylight in Maggie's Southampton was designed with a curved surface that diffuses light into the centre of the kitchen (Figure 6-5b):

It [light from the skylight] is a very soft, lovely way of bringing light in, and diffusing it into the space. We had used it once or twice on other projects that we find it really successful (O'Dwyer).

Rather than maximising openings and glasses, Gough followed a more domestic approach by applying a Georgian-style window rhythm in the design (Figure 6-8), as he claimed that the best way of creating a balance between light-shade and thermal comfort is following the traditionally learnt way of the local architecture, which also promotes a sense of belonging:

Well, what is interesting is that Georgian houses have about an equal amount of windows and walls, and that produces very pleasant light in Georgian rooms. Terraced housing has windows where you get a bit of brick, a bit of window a bit of brick, a bit of window. That seems to be quite a nice balance of a sense of enclosure, and good views, and the amount of daylight that you get. So this building was just built on that, it does not have too much light, it does not have too little, it is balanced. And, of course, that is good for not overheating in summer and not losing too much heat in winter. So it is not a sort of all-glass extravaganza. And neither is it a solid building with small holes. It learns from Georgian architecture more than anywhere, how much glass to put in, and how much not to put in. One of the *lavatories is particularly nice because it has got a lovely, great window. Onto the main balcony by the kitchen, there is a wide full-width window, which is a sort of gesture towards that being the way out onto the balcony. But other than that, windows tend to be fairly conventionally set. Quite domestic.*

Figure 6-8: a) Georgian house, Liverpool, b) Maggie's Nottingham.

Also, the naturally reflected colourful lights were employed in Maggie's Southampton and Maggie's Forth Valley to give a dynamic life to the building. In Maggie's Southampton, the light together with the reflection of vegetation in the centres were brought by big windows and reflective polished concrete surfaces:

We have these amazing reflections on the floor, bringing the colour and the atmosphere in the gardens right into the building through this kind of reflective finish [polished concrete floor]. This amazing picture-framed view can change quite dramatically, depending on the season, depending on maybe the orientation and the view (O'Dwyer).

6.2.2.5. Colour

Either using a more natural approach or a contemporary approach, architects employed colour as a tool to contribute to their goals. For example, Gough chose a green colour for his building, because it would be in a harmony with the surrounding trees and green is the symbol colour of Nottingham. The striking red colour of Maggie's West London was aimed to stand out in contrast with the pale hospital campus, and thus attract people. Whereas in Maggie's Southampton, more earthy natural colours and clay were chosen in the ceramic walls, combined with pastel blue and pink tones to support wayfinding, as they used various colours in the walls for this purpose:

We have got four ceramic walls…The two walls go north-south. So, we used one colour on the entrance wall so that when you are in the building, not necessarily knowing the orientation of the walls, you will remember that you entered the building and came in past the light blue wall. It gives you a little bit of orientation *when you are in the building... For the east-to-west walls, we used pink, the lighter colour, but when you are inside the building you are mostly seeing the terracotta colour, the natural colour of the clay. That enforced the relationship to the outside nature. When you are outside looking in, you see the front of the blocks, the glaze colour the light blue or light pink. It has more reflectivity too. So, you get a bit more in the greens and blues and the shadows, and the blue has a link to the sky. The greens work quite nicely. The blue and the pink helps a little bit with the wayfinding and navigation.*

Figure 6-9: a) Maggie's West London, b) Ceramic wall in Maggie's Southampton.

6.2.2.6. Inside-Outside Effect

The connection between indoor and outdoor environments is another important feature of Maggie's Centres, according to the results of the meta-synthesis analysis described in Chapter 5. Interviews confirmed that these connections were intentionally aimed by the architects, and it can also be applied in clinical settings as it was one of the most commonly recommended environmental features in Chapter 4, having easy access to outdoor settings, removing barriers, and ending a strong inside-outside connection. Howells emphasised that it is not easy in the UK to use outdoor settings in a planned way, as the weather conditions are unpredictable. However, architects were keen to create a connection with the outside in a more protected way. Big windows, doors, canopies, interior garden (courtyard), glass house etc. were successfully included in the designs:

In the UK, we have to be careful, we cannot assume that we can use the outdoors. But one of the things factored into my research is the ability to use it whenever you can. So, the ability to just simply step from, as I say, a consultation room outside, I basically do not have to go down a corridor or downstairs to do this. I just literally open the door and walk outside. And that is something really important for us and our visitors. There are so many things that are difficult to achieve, whilst you are

> *going through some of these cancer experiences that they are having. So, we may cover things easy, right? The idea, if you can see the loch [view outside], let's find a way in which you can simply open the door to be outside. And each of the centres has a similar something whereby that catches your attention, you can get to it. We intentionally reduce the barriers within the centre, because we know that there are so many barriers in the person's life in other respects (Howells).*

The elevated structure of Maggie’s Nottingham also aimed to enhance the connection with the outside environment:

> *The main idea of the Maggie's was to put perch [sic] the building up in the tree canopy rather than down where the tree trunks are. You are kind of up with the branches. Then we have outside balconies coming out of the space. Not just look at the trees, but can almost shake hands with a tree because the branches are coming over onto the balcony, and you can sort of feel you are in them (Gough).*

Howells told that this ability to bring the outside in also helps to air quality as they can easily ventilate inside, particularly after the COVID-19 pandemic, the need for ventilating the spaces increased:

> *COVID times there is a lot of ventilation, so we use whatever ventilation is going on. There is a very discreet kind of vent then that we can open, then the doors. One of the things which are important in Maggie’s Centre is the ability to let the outside in. So, all of the doors, for example, in this centre all the windows are French windows, so you can open the window as if it is a door.*

In conjunction with the following section, sensory stimulations were usually provided through gardens by the Architects, and these experiences were brought inside by creating a strong inside-outside effect, as Haylock expressed:

> I think the connection to the outside is very important, even just to see the weather to see the flora and the fauna and the wildlife. Even if in the corner you can see a tree moving, it has another stimulation, in another connection. And that was very important to us [in the design]. For example, you may see some windows that you think they have strange high, a waste part. But those windows are for there, when you're sitting on a couch or laying on a bench, you can actually see through the windows as well, you could see the outside. So, we are very mindful of different experiences from different types of spaces.

6.2.2.7. Multisensory Environment

The architects aimed to create a multi-sensory environment mainly with vegetation, attracting wildlife, the smell of wood burning fire and water elements. However, as explained above, the gardens were the main source of multisensory stimulation, as Haylock defined the winter garden with its sensory characteristics: "the pillars of greenery and lushness and smells and a different environment…"

Howells, as an expert in this area, highlighted the importance of a multi-sensory environment:

> *One of the things I do daily with people, and just very simple by design, is to help them to deal with what is going on in their heads, I often invite them to get involved with our senses, and engage with our five senses. That is what Maggie's Centres do, there is a wealth of opportunity when you find yourself getting lost in difficult thoughts to actually be with your senses. Being with your senses is one of the most basic therapeutic things a human being can do. Because as soon as you are with what you can see, or what you can hear, or what you can taste, or touch, or smell, you are not caught up with this kind of difficult chatter in your head. [For example] If you are bathing your children at night, and you are really lost in the bubbles, and the giggles, and the smells and the warmth of the bathroom and all the way you can see, If you are truly letting your senses really absorb all of that, you are not in your head with any worries about the next day. And it is the same within Maggie's Centres. I mean, there are spaces where you are actually invited to talk because that is good, that is therapeutic. But there are other times where you can actually do what we are suggesting, just get lost in your senses rather than lost in your head. So, this is built into every single Maggie's Centre. And every single one of them has a way in which somebody can get lost in their senses rather than lost in their head…. People say that they just feel stilled by it. I would say that in every single centre, there will be a space where people will gravitate to.*

6.2.2.8. Thermal Comfort

In terms of thermal comfort, the buildings aimed to get maximum sunlight as in the UK the solar gains for thermal comfort have to be maximised. Brittain explained their approach: "The building faces south to maximise solar gain, with solar shading to avoid overheating." Howells also explained that all the centres employed operable windows, French balconies, etc. which also allows users to adjust the thermal comfort when day need.

Furthermore, the fireplaces help the architects to create thermal variability and comfort as well as entail a homely focus and the sensory experience contributed by burning wood as Harbour explained: “Maggie's said that we like to have a fireplace because it's a focus for home. Beyond that, I think, the warmness, comfort and smell of it [fire]…”

6.2.2.9. Welcoming Relaxing

The post-occupancy evaluations showed that the centres were successful in terms of offering a welcoming and relaxing environment for both visitors and staff. Users like to spend their time in the buildings, and instead of just visiting shortly for consulting and therapy, the inviting environment encouraged them to participate and socialise with others. Brittain explained the feedback they received:

> *The post-occupancy feedback has been anecdotal from the centre head, with whom we have a close relationship. We have heard many stories of how the staff feel uplifted by the building, as well as many reports from the patients. They have described the building being used in many unexpected ways, beyond the counselling and therapy sessions, such as for quiet respite between treatment, sunbathing on the roof and even a wedding! This has demonstrated that the building has been successful in helping users feel at home and relaxed in the building. There is now also a successful Monday men’s group which brings a lot of men to the centre (Brittain).”*

The architects’ approach to creating a welcoming environment primarily tended to arrange a homely environment via comfortable furniture choices. O’dwyer said the furniture is one of the most important features that make the centres welcoming and relaxing. So, they spent plenty of time choosing the furniture and making sure that they've something that users feel very strongly about. Haylock also highlighted the importance of furniture:

> *The furniture changes as further you go into the building. At the entrance, the furniture is quite high and is kind of approaching furniture like a barstool. When you get further into the building you may sit at a dining room table, to have lunch or to have a conversation. Then when you get further into the building, you have the lounge chairs and chaise longues where you can really chill and relax. The element or material of the furniture is also important. It should make people feel*

comfortable because it can be quite intimidating going into a new building. And certainly, if you have cancer and there are lots of things going on in your mind, all you want to do is just to escape for a moment…That is what you can do at the centres or if you would like to have some help, some support. It is also there.

As emphasised in Chapter 5, the architects also supposed that not having a reception desk supported welcoming feelings. Haylock explained how this changed the way of greeting people:

> *The selection of the furniture as you go into the building is really important. There is no reception desk. So, when you're first welcomed into the Centre, it's not welcome with "Good afternoon Bekir, how can I help you today?", it is "Good afternoon. Hi, how are you doing, I have just put the kettle on, do you like a cup of tea?" So, it is that kind of welcoming, which is really relaxing, it is not confrontational at all. It is just like you just walk into your home room, or you walk into your kitchen. It is that kind of feeling that is really important.*

The kitchens are the focus and main space of all Maggie's Centres which were also accepted and designed as one of the most welcoming parts of the buildings by the architects. Haylock explained one of the phrases they used to express the kitchen's welcoming impact:

> *There were a couple of phrases that we used a lot to explain the building to colleagues and different consultants. I think one that sticks into my mind is it [the kitchen] is like having a coffee in your best friend's mom's kitchen. If you think about that, what does that mean? It means that once you are having a coffee, you are very welcome. It is your best friend's mom's kitchen, there is a sense of relaxation, but there is also a sense of respect. So, you do not abuse the space. You look after it. But there is a kind of feeling that you are welcomed. You could help yourself to a coffee and biscuits and so forth.*

O'dwyer claimed that giving chance to think, at the entrance and observe what is happening inside the centre is important to welcome and attract people. Therefore, they provided a visual connection inside by leaving straps on the ceramic wall (See Prospect and Refuge in the following sections) and a glass door through which visitors can see inside.

Architects aimed by designing fireplaces to offer a homely welcoming feeling and improve socialising quality of the space. Howells said the fireplace is one of the welcoming elements of the centres, particularly in the first impression:

> *If you walk into Maggie's Forth Valley, there is a wood-burning stove, but also a view of the loch. So, you are not confronted with anything associated with cancer or potentially any of your problems, you are actually associated with things that are symbolic of beauty and warmth and comfort. Those are first impressions and the building's impact. I think it is a thing that they are not expected. It is unexpected but in a good way.*

Another aspect stated about Maggie’s Centres is the comfortable toilet facilities where users can find privacy and space to be alone. Privacy and comfort in the toilet were one of the issues detected in the systematically searched review (Chapter 4), therefore, the toilet system in the Maggie’s can be adaptable in clinical settings. Howells stated that even it is welcoming for some staff to be able to “linger in the loo”. Toilets were designed to have extra space where people can sit alone and be able to cry without being seen. Gough also designed a toilet with big windows where plenty of daylight comes in.

Not having signs in the centre enhanced the non-clinical homely feeling. According to Haylock, their design intentions to reach a welcoming, relaxing and socialising quality of the space were supported by this approach:

> *We made the buildings feel like home. We become to remove all the introducing things. You do not see any fire escapes signs. You do not see any toilet signs. You do not say see any arrow saying that this way to the reception, or library over here. If you want to know where the toilet is, you ask. I think that is part of the interaction. Also, as part of psychology, if you go to the toilet the staff will know you are in the toilet. So, if you have been there for a long time, they can come and knock door ‘Hi! Everything is okay?’. So, lots of levels of circumstances, which is fantastic. It works so well.*

6.2.2.10. Prospect

As it is the same in all Maggie’s Centres, there are no reception desks, and the entrances are welcoming with a non-institutional feeling. Maggie’s Southampton’s prospect and refuge approach at the entrance promoted the welcoming impact as they arranged the entrance lobby as a place where people can enter and pick leaflets to get information and see the kitchen through straps on the ceramic wall without being seen by the people inside, so they can decide to enter or leave without feeling any obligation (Figure 6-10). O’Dwyer explained their design idea:

We have a big glass door and you are able to see into the building. Therefore, you can go in. When you arrive inside the building, there's a shelf of leaflets, so you can read those leaflets. If you want to go further into the building, if you feel like it's the right time for you to do that, then you can do that. But not everyone wants to enter the first time they go. Maybe they want to just take a leaflet, read it in the lobby, and then leave. And I think, it was always about having a reasonably large entrance, like a lobby where you can see right in. When you are in the lobby, you get these glimpses through the straps, and you can see into the kitchen table, if you see that you want to go in further, it is really up to the person to decide to do that.

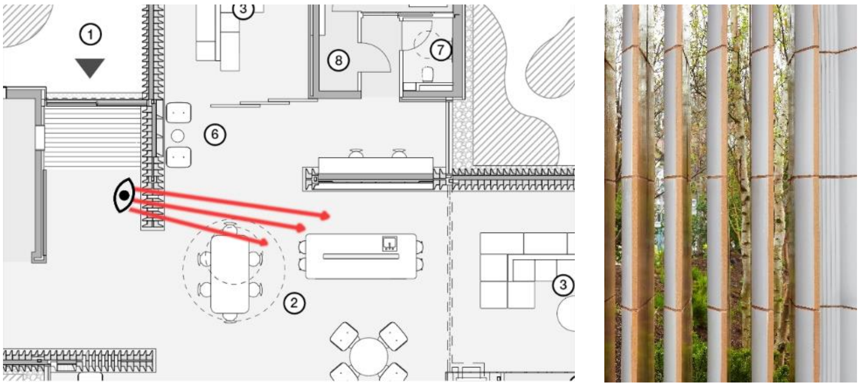


Figure 6-10: Maggie's Southampton visual connection through the ceramic wall straps.

6.2.2.11. Refuge- Feeling Safe

The architects tried to create a refuge where the users were ensured with feeling safe. Using natural elements was quite common to reach this goal. For example, as mentioned before, Maggie's Southampton arranged landscape and vegetation to promote feeling safe, or Maggie's Nottingham was elevated from the ground level, like a treehouse, which also helped to create prospect and refuge. However, Gough claimed that although there is a prospect and refuge effect, it cannot be generalised for everybody as everybody is different and has different feelings about nature and feeling protected. Brittain and O'dwyer claimed that their key driver was to design the centres as an oasis where people take refuge and relaxed as the site is surrounded by the hospital environment:

Creating the building's own oasis was a key driver in the scheme – there was no relaxed outlook and we did not want the building to look back at the hospital so we created its own sheltered courtyard surrounded by mounded landscape. This provided a green therapeutic outlook with a calm courtyard which all the main spaces look out onto. It also benefits the surrounding buildings and car park by creating a green pocket in the hospital grounds (Brittain).

Howells conveyed her experience that the predictability of the centre promotes a feeling of safety. Her observations during the COVID-19 lockdowns supported her perspective:

> People are working from home [Due to COVID-19]. For the first time ever they are able to contrast… Why do they really like being in the centre?…. People say that there are things which they miss about the centre; a sense of containment, a kind of it is a safe place.… Ironically, it is [centre] giving a sense of certainty in an uncertain world. When people walk into Maggie's Centre, they will be always walking into the same scene, maybe walking in with a different emotional state or a different set of questions in their head. But they are always walking into the same safe space, which is predictable. While life is all completely unpredictable. When they walk into Maggie's Centre, they can predict what they are going to find. There are different people, but it does not mean that they can always predict the people that are in it. But they can always predict the setting. It is going to be uncluttered, it is going to be attention to detail on the walls, there is light, there is the view that you admire… The Maggie's Centre actually then acts as a kind of decompression, it is a decompression space. When they enter, they are walking towards a difficult potentially difficult conversation, but in a surrounding that gives a sense of safety because of that predictability of it. After the conversations are finished, they are not just pitched off a Zoom meeting and they are back on their sofa, they take leave of that difficult conversation being in the surroundings, perhaps having another cup of tea, going to the toilet, or just putting on the coat. It is the way that the building sets the stage and it creates the agenda… you cannot do that on Zoom or Team's call, you just pitch in and then you pitch back out again. And so, all that important decompression is lost. It is the building that does that. If there was not a building, then it would not happen. And the quality of the building and the predictability of the building is the other important thing."

6.2.2.12. Privacy

In general, Maggie's Centres provided private spaces for therapy and conversations and corners or spaces where the visitors can withdraw for a while. Also, the privacy level of the rooms was offered to be arrangeable based on the visitor's wish:

> The doors to the consulting rooms are sliding so that users can decide the amount of privacy they require. This allows an informal and more subtle connection

between spaces, as even during private discussions, some people prefer to keep the doors slightly open (Brittain).

Moreover, the COVID-19 lockdowns revealed an auditory sort of privacy opportunity for Maggie's Centres:

> *So, I was talking about the idea of the change in the ambient sound, which means that we cannot rely on ambient sound to create privacy in terms of conversations. So, it is tricky having these two conversations going on in the same space because you can overhear them. Whereas normally, you would not, because there would be enough chatter there would be enough ambient sound. So that is one part where sound plays in. But the other part of it is that, particularly at the moment, households are very busy. If they have children, or if people are working from home, or you have got husband upstairs working from home, wife downstairs working from home, children at the kitchen table, everybody in the sitting room trying to work, then it is awful. So, Maggie's Centres have been a space of tranquillity as well. They are not comfortable and cannot speak openly because do not want to be overheard. They missed the most quietness and privacy in Maggie's Centre where they can talk about things that are potentially quite frightening. So yeah, that is definitely been something that we have been observing.*

Although Maggie's Centres provided privacy and socialising opportunities for visitors in a homely environment, the staff sometimes expressed their need for more privacy, as explained in Chapter 5. This problem was also detected by Cullinan Studio from post-occupancy feedback, therefore, the solution was offered for a planned extension of the project:

> *In the extension project, we are also looking at slightly remodelling the office adjacent to the entrance. The Maggie's Centres aim to avoid having a reception, but this was situated to allow passive supervision of the entrance. However, staff find they are approached by visitors quite a lot and do not have quite enough privacy when dealing with confidential issues, such as phone calls. We are remodelling some of the walls to make this area slightly more separated.*

Having expressed the issues about the design process and how they approached a connection with nature, the architects also explained the problems they realised after post-occupation.

6.2.3. The Designs Problems

When the architects were asked about design problems in their centres the answers were usually concerning technical problems or details. This question explicitly asked: *Based on post-occupancy observations, is there anything in the design that you think you should have designed differently, have you detected any problem?* In this regard, Harbour admitted that they overlooked the possibility that sound could come from the street and hit the roof, therefore he claimed that the acoustics probably could be better internally if they had noticed this problem earlier. However, this problem was eased to some extent by using curtains. Haylock indicated a technical detail: "The vents in the roof. They can either open or closed, and I think we should have made them open a little bit. So, it is just a boring technical thing, but I think the Centre works very well, we are very proud of it." Thereafter, O'dwyer said that they actually wanted the sliding entrance door to be automated, but the client did not agree as it will make the entrance less of a homely environment, so a pivot door could have been a better option. Regarding these sorts of detail or technical problems, Gough said that the feedback can reflect the individual opinion and might not be applied to everyone:

> *We have had some feedback from the director who is now left. She had quite a lot of comments which were critical, or not critical, but she suggested various improvements. And funnily enough, now we have a new director. I went to see her, and she does not have the same problems. And she is very happy with how it actually is.*

On the other hand, the problems stated by Gough and Brittain can affect all centres someday, and designers should take them into consideration. As explained above in the previous section, staff need more privacy in the centres' visitor-centred and homely environment, they need private spaces for confidential issues. Interestingly, in Maggie's Nottingham they need more kitchen space while the kitchens are the main focus of the centres, they faced an unpredicted problem in time, Gough explained the extension project that they are currently considering:

> *A bigger kitchen, that is the most pressing problem, because what has happened is quite interesting psychology. The original people, who first went there 10 years ago or more, have kind of taken some ownership of it. And they continue to come because they like going there during the day, they like being there. They have really almost adopted the kitchen as their space. And it is more difficult for new people to use the kitchen because it is already full of oldies. They cannot say to the oldies to*

go away. But it's [the centre] partly for new people, and they expect it to be mostly for newly diagnosed cancer patients. However, somehow some people treat it as a club that they are a member of for life, and they keep coming back. So, what they now thinking is that they need a bigger kitchen so the old people do not dominate it. And indeed, there is even some crazy idea that we keep the old kitchen to the old guys, therefore, they could hang on there, and build a new kitchen for people who newly arrived. So, we may end up with two kitchens, which is quite funny.

6.3. Recommendations for Clinical Therapeutic Environment Design

Haylock and his team worked on a hospital project, The Circle Bath, in Bath, UK, where there is an emphasis on natural light and views throughout the hospital. The team did their research in this project to create a healing environment and also used what they learnt in Maggie's Manchester:

Connection with nature in a healing environment, I think the psychology of it is also very important. We did do some studying a few years ago now about the benefits of natural daylight and the connection to landscaping in a hospital. And it all helps to reduce the heart rate and increase recovery. So, if you are connected to nature, that means that you get back soon. So, we worked on a project in Bath in the UK called The Circle Bath, and we learnt a lot from that project. And we continue that theme through to the Maggie's Centre. But I would say the Maggie's Centre that we took it to another level.

Based on their research, Foster+Partners decided on their main design drivers that will reduce stress and anxiety by using natural elements and non-clinical feelings. For example, although the building was concrete, timber materials were introduced on the floors and walls to reduce the institutional feeling (Figure 6-11). The location was available to provide a view of the countryside landscape, while they also designed private and quiet gardens around the hospital. Therefore, they maximised the view and natural light in the building. Furthermore, Haylock also emphasised on sensory experience that the olfactory and auditory elements should lessen the clinical feeling, along with thermal comfort as the hospital environment is usually hot. Lastly, interior design and furniture choices should be more domesticated and homelier to evoke a sense of belonging and relaxation.

What is driving the design of the Circle Bath hospital was the simplicity of the design, and it is all about making the experience when you visit the hospital as very pleasurable as possible because there is a lot of anxiety when you go to a hospital.

So, we tried to design as relaxing as possible, more like a hotel, more like a spa. So, the introduction of timber and trying to make the building less institutional as possible was one of the targets. Because when people go to hospitals, they have got the smell, the temperature up…, all the furniture and all the environment is so standard, so typical. You even got into that cubicle before you go for an operation, you are feeling that environment. So, we thought that if we can reduce that anxiety, people can be more relaxed. Also, when they recover, that space is more like a domestic hotel room rather than a hospital room. So, having things like timber on the floors, in the invasion bedrooms, would be better than just having an environment of a normal hospital. So, we make the spaces more domesticated, more like home, than a hospital.

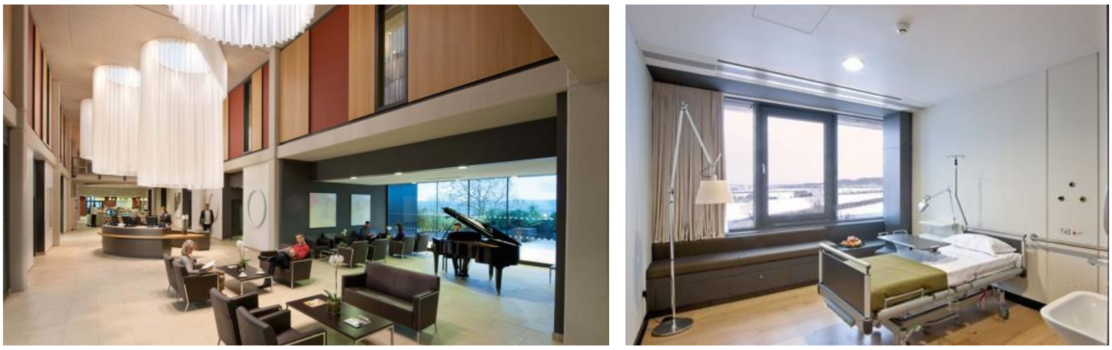


Figure 6-11: The Circle Bath inside.

In Guy's Cancer Centre, a clinical setting opened in 2016 in London, Harbour and his team followed Maggie's Centres' approach and adapted it to the clinical environment. However, implementing natural elements in a clinical setting was more challenging than in the non-clinical Maggie's Centre:

What we implemented in Guy's Cancer Centre was our first attempt at trying to bring some of the philosophy of what we had learnt at Maggie's, into a clinical setting. The key parts of that were, first of all, to distinguish between the science of technology and the art of care. So, that was our first distinct division and the building is literally split insight. The art of care, backed up by the factory, is the science of treatment. Except that you have this high-tech space, where all the machines go ping, but related to a space that you can feel is more human. And it was a real battle… Because the people that are charged in hospital's infection control will not be allowed to treat as anywhere else… And what we managed to achieve in Guy's was really how far we can go down this concept of being aware of the border environment of nature.

They worked with specialists to understand space organisation requirements, and then developed a new approach to lessen clinical feeling through spatial design. The scale of the building was domesticated and humanised by dividing the departments into a new understanding. Also, the design provided easy access to different settings as all relevant facilities were bubbled in the same divided area, called 'villages'. The new organisation also aimed to maximise contact with nature (Figure 6-12). For example, people who had experienced radiotherapy tend to receive it in the basements in usual healthcare settings which was described 'airless dungeon' where no daylight or fresh air comes in, however, the architects managed to plan the radiotherapy on the second floor where the patients have access to many natural features they were deprived (Figure 6-13). The balconies were aimed to bring the notion of a garden, and big windows created contact with nature, and light and offered view and fresh air as much as possible. Timber was also integrated as a material to enhance the homely and relaxing feeling as well as the colourful walls and surfaces (Figure *6-14*).

> *The first aspect beyond the splitting was to bring the scale of the building down. So rather than feeling as if you are in an edifice. This is a building of 14 floors effectively, but it is divided up into four 'villages'. They bring together some clinical aspects in there, day cases minor operations, chemotherapy, radiotherapy, and complementary therapies. What we have done is to break the building out, there is a common very informal reception, you would not even really understand it as a hospital reception, in a sense picking on some of the strengths of Maggie's. It's still, unfortunately, got an NHS-type typical café… When you go into the lift, you basically got three buttons, the buttons have the name of the floor, so radiotherapy is a button. So, the point is, it is not relevant what floor you are in, what is relevant is where you are going. And when you arrive in that radiotherapy village, which is a three-storey high village, you have greeted there as well. And there is the art of care piece, it is a much more human scale, it brings in a lot of timber as a material, there is a lot of daylight, there are balconies, which feel like outside. We have tried as much as we can to bring the notion of the hospital garden onto up the buildings, so they figure on the balconies.*

Harbour highlighted that they also aimed to provide a better workplace for staff by providing private staff areas where they have Views, Prospects and Socialising opportunities. This also contributes to the problems commonly stated by staff in Chapter 4:

> *There are also aspects for the staff, staff coming together and having a relationship*

with their staff area [facing] to the street, so they can see people coming and going. It's not tucked away, around the back.

Overall, Harbour claimed that some of the approaches in that hospital were quite radical approaches, which were inspired by Maggie's Centres, and are quite successful based on feedback and rewarded specialist care and architecture awards. Another aspect of this success was that the design had very strong patient input, the patients were actively involved and conveyed their opinion on how the design really works from the users' perspective. Thus, this building can be an example of a new standard for clinical environments according to Harbour.

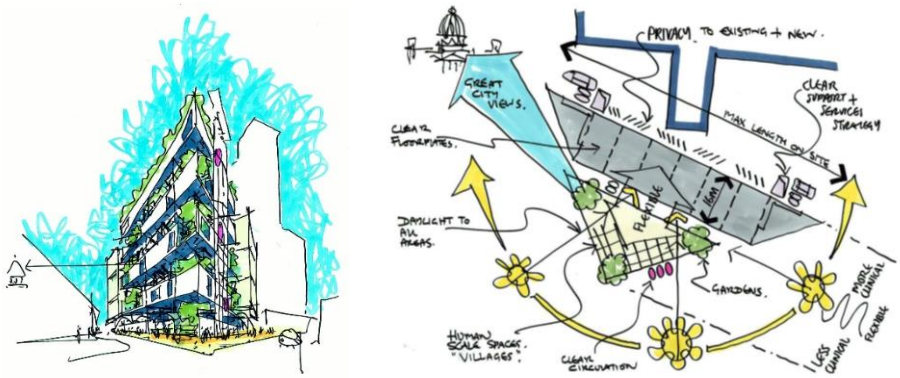


Figure 6-12: Sketches of design decisions in Guy's Cancer Centre.

Figure 6-13: The villages, shown in the section of Guy's Cancer Centre.

Figure 6-14: Guy's Cancer Centre.

In order to design clinical settings using Maggie's Centres' approach, the architects should consider every detail deeply and rigorously as designing a clinical environment comes with a problem of risk and responsibility. Harbour said that, for example, cleanliness as a measurable thing is ranked higher than the quality of space, thus, the designer should consider solutions where both mutually exist. Another recommendation was to think adjacencies very well:

> *We discovered that the design of a hospital is all about adjacencies between what is considered important to the people working in the hospital. And what sort of adjacencies are agreed no one dares question them or tries to rationalise them to make a building more understandable. So, adjacency is most important.*

Lastly, Harbour explained a risk that they discovered after the building was designed which was in relation to budget, as the hospital said they were not able to afford a second receptionist as normal hospitals have one reception area:

> *The old patients came to help again, they have a volunteer network. So interestingly, someone had a very clever idea. Well, the volunteers could be sort of staff in the villages to help patients. So, it gave them a sense of space, a very like a small-scale little hospital of their own, to become just friends, to get advice. So, sort of working in the way that Maggie's works. They do not quite yet offer the cup of tea, because of course, they do not have the tea points.*

According to O'dwyer, biophilic design and Maggie's architectural philosophy can be adaptable in clinical settings, at least in waiting rooms, entrances, outdoor settings or corridors, but the main barrier to reaching this standard is budget. However, the benefits of connecting with nature by reducing stress and anxiety can also help to save money by reducing stay time in the hospital: "If you spend more money on a better healing process, potentially people will spend less time in hospitals."

Similar to the other architects, Brittain recommended similar approaches for clinical setting design. In her point of view, connection to nature is key, and providing a choice of space to meet people's requirements – quiet, calm spaces, and more social areas. In order to create the best connection in a clinical environment, she highlighted that having a view of nature helps with many aspects such as wayfinding, orientation and aspects such as circadian rhythms. Also, the principles people find therapeutic in nature can be used in buildings, such as evolutionary principles – legibility, mystery, coherence and complexity – as well as good daylight and use of natural finishes, water features etc.

> *We have not designed large-scale clinical hospitals but with Maggie's we were able to follow domestic principles rather than strict infection control protocols etc. However, there are many spaces in hospital settings which do not need to feel institutional, but can be welcoming to users, and have good wayfinding, natural light and materials.*

Brittain is currently working with the Alder Hey Children's Hospital in Liverpool on a new extension and inpatient mental health facility for young people, the Catkin Centre and Sunflower House, which brings together a range of clinical services in a therapeutic setting. The office is also working on the redevelopment of the surrounding Springfield Park, creating a holistic healthy setting for the hospital and the surrounding community. Their primary aim in this project was to make the building as non-institutional and welcoming as possible. This aim occurred from the first interaction with the building, which was from the under croft car park:

> *We ensured this was as light-filled as possible with views to a planted embankment, and visitors could start their approach to the building through a landscaped route.*

Similar to Harbour's approach, Cullinan Studio also followed Maggie's non-clinical feeling philosophy to some extent. The inclusion of timber as a Natural Material, Colours, View, and Greenery were emphasised:

> *Both buildings are focused around a courtyard, providing constant views of nature and a clear sense of orientation. We are aiming to minimise signage, but use colour for wayfinding where possible. There is a timber cone structure that brings natural light into the central waiting space, and there is a choice of types of waiting spaces to allow for different requirements. The residential building is made from CLT (Cross Laminated Timber) panels and we used the timber as a robust, natural finish in all the communal spaces and bedrooms. The consulting rooms have bay windows to*

bring a child's sense of scale to the space, and avoid soulless square clinical feeling spaces.

The strict standards and budget were indicated by Brittain as the facts why creating contact with nature was more challenging in this project than in Maggie's Newcastle:

The Sunflower House inpatient facility had much more stringent requirements as it was all designed to Tier 4 mental health standards, with anti-ligature fixings and clear passive supervision throughout. However, we feel it has still retained a clear non-institutional feel, with break-out spaces and a generous courtyard, bay window desks in the bedroom etc. Also, the budget was a difficult constraint as with all NHS projects.

Figure 6-15: The Catkin Centre and Sunflower House in Alder Hey Children's Hospital in Liverpool.

Apart from the previous comments, Gough highlighted the use of plastic material and smell in clinical settings as the main problem that reduces the quality of space. Natural materials and comfortable furniture with nice and soft fabric can promote quality. However, as also stated in Chapter 5, he claimed that the decision-makers and clinicians will not easily accept changing the system, "I think the clinicians, not good psychologists, they think that it's all about a process, it's like you're in a machine for getting you better", whereas they tend to be more flexible in children hospitals:

I would love to do it [designing with these ideas]. But I am quite sure, I probably lose the argument against the clinicians. There is a whole history of how things are done. The suppliers, the whole way in which hospitals are procured through PFI or whatever, absolutely militates against changing its formula. And the formula is a bit worrying. We should probably look to children's hospitals to see where compassion is allowed to come in. They tend to be more gentle, and less clinical, and I'm sure there is an equal need to be clinical, but they somehow soften it. Because it is *children. They think they have to, they should. Just because you are grown-up does not mean you do not have the same emotional needs as when you are a child.*

6.4. Concluding Remarks

The semi-structured interviews allowed to look deeply inside the efficacy of biophilic design parameters and practical implementation in the non-clinical and clinical therapeutic environments from the expert point of view. The synthesis of findings in this chapter helped to have an insight into decision making and design process, some design problems that architect had faced, and design recommendations, and also helped to understand the importance level of biophilic design parameters that appear the most critical from experts' perspective for promoting and supporting human health and wellbeing. The experts underpinned the importance of Greenery, Daylight, Natural Material, Colour, Views, Welcoming Relaxing, Prospect and Refuge. However, different than findings in previous chapters, importance and benefits of Water was highly emphasised, particularly in non-clinical environment where the application is less restricted. Therefore, particularly ranking of Water parameter have been affected in the new conceptual biophilic framework which is presented in the following chapter with design guideless for clinical and non-clinical environment design.

CHAPTER 7

7. DISCUSSION OF THE FINDINGS: BIOPHILIC DESIGN GUIDELINES FOR THERAPEUTIC ENVIRONMENTS

This chapter discusses and synthesises the results obtained from the three different methodological approaches examined in Chapters 4, 5 and 6: the meta-synthesis, the systematically searched review and the semi-structured interviews, which were supported by the data from the narrative literature review (Figure 7-1).

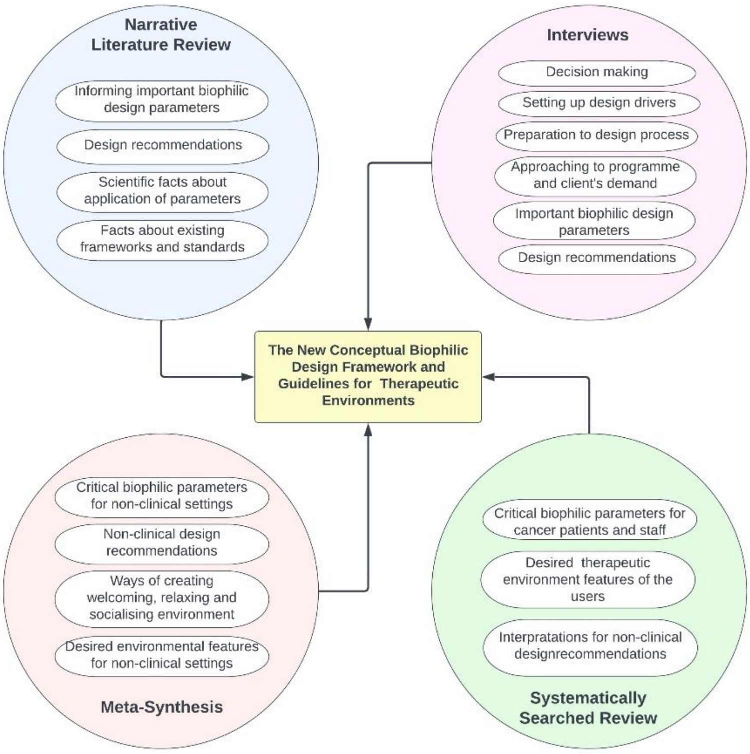


Figure 7-1: Data compilation map of the biophilic design framework. (Systematically searched review part is updated)

Although the meta-synthesis and interviews supported and shaped the framework for non-clinical therapeutic environments directly, the narrative literature review and the systematically searched review fed and encouraged the framework with the interpretations of the researcher since they were extensively focused on clinical environments. The data from the clinical environment cannot be directly applicable to the non-clinical settings, such as Maggie's centres, but the patient's needs and statements give us benchmarks that can be translated into their non-clinical environments. These benchmarks are what should be provided for vulnerable cancer patients since the most vulnerable person gets affected by the building and environment the most. However, we cannot adapt buildings to this population one hundred per cent, as the needs of people with cancer (including different types of cancer, age, gender, type of treatment, stages in the treatment, etc.) differ from one person to another. For example, not all types of cancer patients have issues with infection control as strictly as patients in with haematology treatments. Thus, we cannot use everything detected in a clinical environment in a systematically searched review in non-clinical design, but this data shows what is important for patients. Therefore, the final results were critically examined in this regard and comprehensively combined to holistically present those key biophilic design parameters and design applications.

With this in mind, all results are summarised within a holistic framework (Figure 7-2) that presents the analysis from all research methods in three different steps: the first part of the framework states the recommendations for the decision-making and design process; the second step identifies and groups the critical biophilic design parameters; the last step conveys the summary of design recommendations revealed throughout the research. The important biophilic design parameters for non-clinical settings were defined for the whole setting, given that these types of settings are commonly small and less complex buildings.

The framework also aims to inform designers about the criteria that will make their designs biophilic. All parameters included in the framework are critical for the therapeutic environments, based on the research reported in this thesis. The order of importance was grouped mainly based on the results from the meta-synthesis and the interviews, however, the systematically searched review results and the narrative literature review also affected the level of importance. For example, Fresh Air and Thermal Comfort's rankings were increased because they were highlighted in the studies examined as well as the current certifications (WELL certificate and Living Building Challenge). Thus, each of these four levels of importance (groups A, B, C and D) will help to understand and apply the parameters in the design processes in a more efficient way. The order of importance shows that Group A (Fresh Air, Light-Sunlight, Greenery) represents *extremely important* parameters which are the most critical biophilic design parameters for users, therefore, a designer cannot claim a space as biophilic design if the space does not employ even one of the parameters represented in this group. Group B (Multisensory Environment, Refuge-Privacy, Sense of Belonging, Thermal Comfort, View, Prospect, Water,) represents *very important* biophilic design parameters which are almost as important as the parameters in Group A, however, these parameters were considered in the second group not because they were indicated as less important but because the users emphasised their need for the parameters in Group A was more than the parameters in Group B. To create a biophilic space, designers should employ all the parameters in Group B rigorously, nevertheless, they can be disregarded only if experts prove that environmental conditions are unfeasible or the application of a parameter in this group can be harmful to some users. The parameters in Group C (Natural Material, Natural Colour, Bringing the Outside to the Inside, Spaciousness, Curiosity) are defined as *important,* and designers should employ these features as much as they can. Finally, Group D (Seasonal Changes, Fire) represents the *moderately important* parameters, but still, these parameters indicated their positive impact on the user's health and well-being, therefore, the inclusion of these parameters in a design will progressively increase environmental biophilic quality.

The following sections explain the design recommendations in the framework in more detail. Having explained the recommendations in relation to the decision-making and design process, general design recommendations for implementing biophilic design parameters and design recommendations for each group of users are explained in consecutive sections.

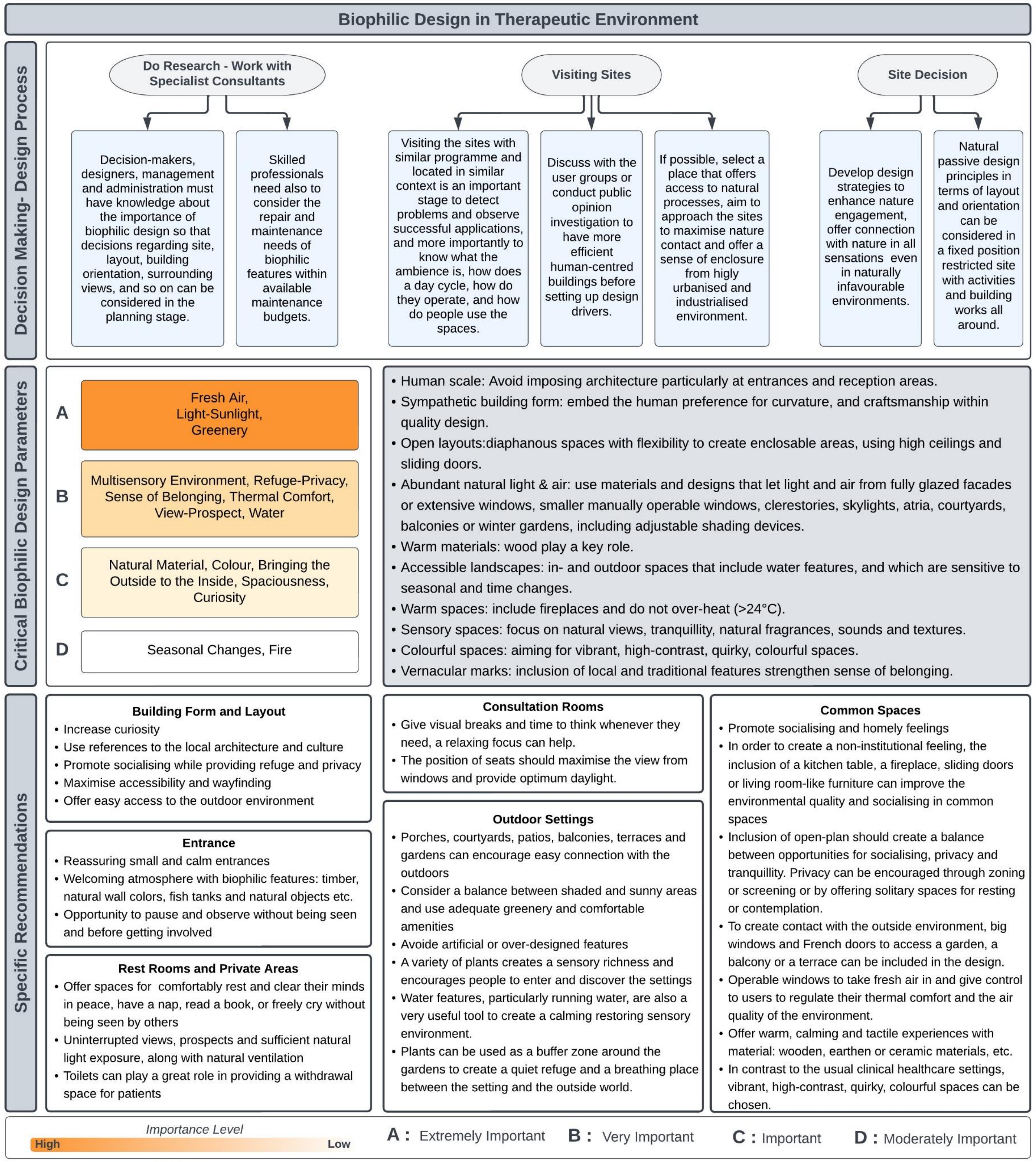


Figure 7-2: New conceptual framework for biophilic design in a therapeutic environment.

7.1. Decision-Making and Design Process

A successful project emerges as a result of harmonious coordination and communication between clients and architects, as well as a non-descriptive and architecturally flexible design agenda offered by clients. As clearly revealed in Chapters 4 and 6, decision-makers, clients and designers should have knowledge about the importance of nature engagement. Based on this research, the most important barriers to creating a biophilic healing environment are generated in the decision-making process before designing healthcare settings. Decision-makers usually do not prioritise nature-based opportunities or 'design thinking'. Functionality, efficiency, cost restrictions or habitual practice are often the main concern of healthcare facilities' design regardless of the patients' opinion and the quality of their experience. In order to eliminate these barriers, decision-makers, designers, management and administration must know the importance of biophilic design so that decisions regarding the site, layout, building orientation, surrounding views, and so on can be considered in the planning stage. Skilled professionals need also to consider the repair and maintenance needs of biophilic features within available maintenance budgets. Furthermore, the lack of knowledge and ability of the designers also leads to inappropriate design choices and executions, such as: cold and stark spaces; too much hardscape, glaring materials or materials too hot to the touch; uncomfortable furniture; environments that are too demanding, complex, static or under-stimulating; insufficient shading or lighting; and structures that cast odd shadows that could raise anxiety. In order to prevent these wrong implementations and to adopt a biophilic design philosophy appropriately, doing research at the beginning of the projects or consulting with specialist consultants can be efficient approaches as recommended by the interviewed architects. Research findings and consultant advice should be adopted in the designs through brainstorming processes and absorbing all imagery and ideas in an open-minded state with all design teams and clients if applicable.

Furthermore, during the decision-making process, visiting sites which have a similar programme and are located in a similar context is an important step to detect problems and observe successful applications, and more importantly, to know what the ambience is, how a day cycles, and how do people operate and use the spaces. Along with the site visits, it is highly recommended that the designers discuss the project with the relevant user groups or conduct public opinion investigations before setting up design drivers, so that this will lead to more efficient human-centred buildings.

Additionally, if the decision for building located within the given site is left to the designers, they might aim to approach the sites to maximise nature contact and offer a sense of enclosure if the site is in a highly urbanised, industrialised and crowded environment. In any case, enhancing nature engagement should be well-thought, and solutions to offer a fully sensory connection with nature must be well-considered. The designer's goal should be to connect the spaces within the building as closely as possible with outside spaces and to provide a green outlook, psychologically separating it from an undesirable clinical setting feeling. Natural passive design principles in terms of layout and orientation can also be considered to achieve this.

Although the priorities or level of importance for either type of setting differs for programme guidelines, spatial considerations and requirements in different therapeutic settings the recommendations stated above are applicable in all types of therapeutic environments. However, the design strategies and biophilic parameter requirements differ based on the user group and purpose of use.

7.2. General Biophilic Design Recommendations to Create Therapeutic Environments

Examined literature and research on biophilic design in this study showed that some biophilic design application principles arise as specific needs of this typology while the application of some other principles can be generalised.

Firstly, a designer should prioritise working with real nature and natural elements, or at the very least simulated nature should be considered where the application of real one is not possible. Also, prioritising biodiversity and variability increases the efficiency more than the quantity or area of natural elements.

The spatial organisation should allow users to exposure to natural views and multisensory natural environments for at least 20 minutes per day but no less than five minutes at a time. Thus, designers should consider how to enhance visual and non-visual connections in detail, such as user routes and circulation of the building that regularly passes across natural areas or arranging spatial layouts and furniture to provide uninterrupted view lines to natural landscapes in a seated position. Moreover, a simultaneous experience of visual and non-visual connection maximises the restorative quality of an environment.

As in nature, a biophilic design application should also reflect non-rhythmic stimulation on the senses, where the efficient frequency of non-rhythmic stimulation is about 20 seconds of exposure around every 20 minutes. The best way to create this atmosphere is to bring the outside to the inside and reflect seasonal changes in the space. For example, attracting wildlife (at least visually) through plants or fragrances, reflecting cloud movements or rain, taking a breeze in, or exposing the building to spontaneous natural sounds such as birds chirping or water babbling.

Thermal variability is another stimulating feature in design as the temperature changes non-rhythmically in nature, providing thermal variability in space will increase comfort and perception, however, overstimulation should be avoided. To distribute and prolong thermal variability, designers can incorporate other biophilic design parameters (e.g. fresh air flow, daylight, natural materials) or mechanical and electronic systems can be applicable where necessary. In order to provide healthy thermal comfort, the temperature should be between 18°C and 24°C, but this research also showed that reaching 24°C creates an unwelcoming feeling in therapeutic environments. Designers can avoid temperatures over 22°C where it is safe for users to create a more welcoming and relaxing space, however, they should consult specialists in medicine and doctors for the temperature of specific units and patients' rooms.

An efficient biophilic design considers fresh air level rigorously, and architectural elements for natural ventilation should be prioritised over mechanical ventilation where possible. Therefore, to improve indoor air quality and provide a better state of health, ventilation rates should be higher than 20 cfm and up to 40 cfm per person in space.

In terms of greenery and plants in biophilic design, supporting evidence suggested that a high density of plants in an indoor environment also decreases cognitive performance as well as the quality of space. Therefore, a moderate amount of greenery should be engaged based on the spatial programme. The general concept of biophilia claims that the application of single or isolated plants is not effectively beneficial. Vegetation should be rich and ecologically connected while the plants should be chosen from local species. Although designers should prioritise local plants and vegetation, it should be taken into account that slightly scented plants with green and small leaves are the most appropriate and effective plants for health and wellbeing, whereas red flowers produce a fatiguing impact over time.

Wrongly implementing water elements, as an important restorative biophilic design parameter, can cause discomfort. Repetitive and abundant experience with water can cause a loss of interest. Moreover, a high volume of running water can reduce the acoustic quality of the space and increase humidity. Hence, an optimum amount of water features should be implemented in practice, avoiding exaggeration. Also, the restorative effect of water depends on its quality. Clear water should be prioritised and designers should also consider the sustainability of water quality and its maintenance, as dirty and brown water is less restorative than clear water.

A healthy environment provides an opportunity for direct exposure to sunlight (approximately 3,000 lux) for at least 30 minutes a day. When designing lighting and taking daylight inside, it is critical to consider a balance between dynamic and diffuse light to avoid a negative impact. For example, long-time direct sunlight penetration, changing light colours or sharp transitions can create discomfort. Consideration of circadian lighting is also critical, particularly in long-period occupied spaces, such as patient rooms.

Since human receptors can detect and differentiate real and synthetic materials, real natural materials would be more effective and stimulating. According to studies on timber, the application of wooden materials on 45 per cent of the whole surface creates a feeling of comfort, and over-use can cause harm to cognitive performance. Thus, designers should avoid monotonous overstimulating natural material applications, and can use various materials to buffer and soften overstimulating or boring atmospheres. Likewise, the colour choice should follow the same principles to avoid a feeling of dullness. Moreover, various colours impact human psychology in different ways: soft and natural blues help to feel relaxed as they remind us of the sky and water; shades of vibrant green give energy and make people calm as they are associated with meadows or forests; yellows are warm and welcoming and create a social and energised atmosphere as they remind us of warm summers and the sun; purple and mauves are spiritual and meditative colours, and evoke mystery as they represent dawn and dusk; oranges and reds can be energising, exciting and stimulating as they are the colours of ripe fruits and berries; dark colours are associated with sophistication, depth and mystery, and feelings of security and refuge, but if they are not used carefully the space can easily be oppressive and overwhelming. With this in mind, using colour in much the same proportions and with a sense of harmony as in nature, is an important point to avoid overwhelming people.

Low-level refuge and high-level prospect combinations were found to be restorative, whereas low-level prospect and high-level refuge can increase stress, fatigue and negative emotions. Therefore, a moderate prospect distance should be higher than six meters (short depth), although the distance of the preferred prospect was stated as above 30 meters (long depth). Prospect can be applicable in both interior and exterior spaces; the interior prospect is to provide a visual connection between the spaces and it has a greater impact with the opportunity to see multiple spaces together. Prospect and refuge can be designed and regulated by orienting buildings, corridors, glass walls, or playing with ceiling heights. Also, a refuge space might be created through the use of light and shadow, which can also endow a mysterious character to the space.

7.3. Designing Non-Clinical Settings for Cancer

Based on the analysis of Maggie's Centres and the interviews with a selection of their architects, the following general guidelines regarding the design of non-clinical healthcare settings can be proposed:

- Importance of human-scale spaces: avoid imposing architecture, particularly at entrances and reception areas.
- Sympathetic building form: embed the human preference for curvature, and craftsmanship within the quality design.
- Open layouts: diaphanous spaces with the flexibility to create enclosable areas, using high ceilings and sliding doors.
- Abundant natural light and air: use materials and designs that let light and air from fully glazed facades or extensive windows, smaller manually operable windows, clerestories, skylights, atria, courtyards, balconies or winter gardens, including adjustable shading devices.
- Warm materials: wood play a key role.
- Accessible landscapes: in- and outdoor spaces that include water features, and which are sensitive to seasonal and time changes.
- Warm spaces: include fireplaces and do not overheat (>24°C).
- Sensory spaces: focus on natural views, tranquillity, natural fragrances, sounds and textures, however, overstimulation must be avoided.
- Colourful spaces: aiming for vibrant, high-contrast, quirky, colourful spaces.
- Vernacular marks: inclusion of local and traditional features strengthen a sense of belonging.

In addition to the general summary of non-clinical environment design, each part of the setting should be designed to reflect particular characteristics.

7.3.1. Building Form and Layout

There are two considerably successful design strategies found in terms of the strategic use of building form. Firstly, as a tactic to elicit curiosity in order to attract people to the centre. However, these unfamiliar forms can sometimes prevent them from providing a homely human-scaled environment, thus, the architects should select their drivers rigorously and approach unfamiliar forms well-thought-throughout. Secondly, as a way to create a sense of belonging to the visitors, designers can follow the tracks of local architecture and culture.

In terms of layout design, it should encourage the visitors to socialise while providing an opportunity to withdraw when they need it. The visual connection between the different parts of the buildings is also another necessary contributor to enhancing welcoming and relaxing feelings. Thus, an open-plan approach was the most commonly preferred strategy for layout, as it can also promote a non-clinical feeling. However, this visual and social connection should also be in balance with the needs of staff who sometimes need to be away from the visitors for their personal work and have some break.

According to cancer patients' preferences identified in Chapter 4, ease of movement is one of the most important aspects that the buildings should offer to patients. As such, the maximisation of accessibility and the removal of barriers should be seriously considered. This includes rapid and easy access between outdoor settings, foyer-waiting rooms and treatment settings with safety that must be considered as an overarching priority in relation to movement. For example, the use of non-slip surface materials, smooth paved paths, ramps rather than steps and colour-contrasting curbing along pathways. Barriers to be avoided can be heavy doors, narrow doorways and pathways, etc. In order to provide physical access to the outside, all barriers and thresholds should be removed for patients. In some cases, automatic doors can be suggested to improve ease of access.

The material choice and heating system are another concern in terms of the thermal comfort of the patients, who are usually more sensitive as a result of chemotherapy, as it was reported that the environment often tended to be over-hot in hospitals. Also, as was reported by users in Chapter 5, the material quality and feature are more important than the design or price of the furniture. Therefore, plastic materials should be avoided as furniture options as it increases temperature perception.

7.3.2. Entrance

The entrance to the facility is an important space, as upon arrival people often face high levels of stress and anxiety. Therefore, creating a welcoming atmosphere with biophilic touches can relax people: for instance with the use of natural materials such as wood, natural wall colours, fish tanks and natural objects. As always, safety should be a paramount design criterion, avoiding the inclusion of allergy-inducing elements, and slippery or otherwise challenging surfaces.

Reassuring small and calm entrances can encourage people to enter the building. As these non-clinical environments are envisioned to be environments where the visitors receive mental, psychological and social support, entering the building usually means that they have accepted their illness and decided to fight it, which is a turning point for the visitors. Therefore, the entrance is a space that should be distinguished in its design. Curiosity or familiarity (that promotes a sense of belonging) can be applicable principles in distinguishing the entrances. As learnt from Maggie's Centres, not having a reception desk creates a homelier character and less institutional atmosphere, which also contributes to social interaction among the visitors.

Along with the physical interventions, prospect and refuge should also be considered specific to the design of entrances, where the users should have the opportunity to pause and observe without being seen and before getting involved in any activities and decide to participate without feeling pressure or obligation.

7.3.3. Rest Rooms and Private Areas

Therapeutic environments also offer spaces for users to retreat and rest in more private corners or rooms where they can comfortably rest and clear their minds in peace, have a nap, read a book, or freely cry without being seen by others. As the studies in Chapter 4 revealed that connection with the outside and nature is highly demanded in these kinds of more private spaces. Learning from inpatient environments for cancer patients, windows should provide uninterrupted views, prospects and sufficient natural light exposure, along with natural ventilation. Supporting evidence suggested that approximately 300 lux daylight is sufficient in inpatient rooms, thus, this amount of daylight can also be adaptable in these non-clinical private spaces. Window design should also pay attention to privacy, safety and refuge by providing one-way views. Indoor seats or beds that are strategically located to maximise the use of natural window views can motivate patients to take advantage of these opportunities.

As observed in Maggie's centres, toilets can play a great role in providing a withdrawal space for patients, they can offer a more spacious atmosphere where patients can have solitary break or comfort to cry freely. Studies in chapter 4 also revealed that toilet entrances should be protected from others' sight since some cancer patients need to use toilets more frequently and some reported that they do not want to be seen always waiting for the toilet.

7.3.4. Common Spaces

As Maggie's Centres are the case study for non-clinical settings in this research it is important to understand the kitchen concept as they are the common communal space in Maggie's centres. In the kitchens, the table was the most distinguishable characteristic that promoted socialising and homely feelings. Thus, the common spaces should have comfortable, relaxing, and socialising characteristics as well as provide features that promote refuge and feeling safe. In order to create a non-institutional feeling, the inclusion of a kitchen table, a fireplace, or living room-like furniture can improve the environmental quality in common spaces, as all of them also contribute to socialising. It was particularly noticed in this study that providing a fireplace in these centres, with the smell of burning wood, the crunching sound of it, and the visual and thermal effect of fire itself, was a prominently effective tool to restore the quality of the space. In practice, an open-plan layout provides the highest exposure to daylight and socialising opportunities, but it also creates a noisier environment and impacts the provision of withdrawal spaces. Therefore, the inclusion of open-plan spaces needs more thought in order to create a balance between opportunities for socialising, privacy and tranquillity. Privacy can be encouraged through zoning or screening or by offering solitary spaces for resting or contemplation.

Sliding doors are preferable, as it was found that sliding doors promote a feeling of relaxation and privacy. Also, they contribute to the non-institutional feeling, along with the notion of 'signlessness', in which the settings decide not to use any sign on the doors.

In order to create contact with the outside environment, big windows and French doors to access a garden, a balcony or a terrace can be included in the design. Barriers between the outside and the inside should be removed as much as possible. The most noticeable factor of the inside-outside relationship should be the affordance of visual connection, such as a view of the sky, water or greenery. As some patients do not have the energy to walk around, they should find an opportunity to have access to nature while being inside. Windows should be operable with the aim to take fresh air in and give control to users to regulate their thermal comfort and the air quality of the environment. Although the users are given the option to control the thermal quality of the space, designers must avoid reaching a temperature of 24°C to not remind a hospital ward.

Moreover, various architectural elements can be used to get more daylight inside, such as clerestories, roof fenestrations fitted with selective shading devices, roof openings, atria, courtyards, glass-walled porches, and small openings and skylights. The amount of daylight and ceiling height greatly improves the quality of space and the perception of spaciousness, which helps to stop claustrophobia and to reduce the feeling of stress. Also, spaciousness with the explosion of volume can be used for triggering curiosity and a welcoming feeling.

Additionally, daylight can be a tool for creating a distinction from the usual healthcare facilities, along with the direct benefits of daylight. Since the daytime is quite short in winter (in the UK), artificial lighting should be designed in accordance with the natural light spectrums. This study showed that the warmth of soft light was associated with feeling safe, thus, the artificial lighting use in the buildings can be chosen to be warm (3,000-4,000 Kelvin) or soft (2,700-3,000 Kelvin) range. The lighting should be designed specifically in some rooms, for example, the art therapy classes require bright light, while softer and dimmer light is used in relaxation classes in some of Maggie's centres.

The material choice should offer warm, calming and tactile experiences. For example, wooden, earthen or ceramic materials can be employed in construction. Material choice, organic shapes, and structural elements can be used to attract attention in settings since a visual focus or distraction helps some patients to forget their unpleasant thoughts. However, concrete or steel like 'cold' materials should be softened by combining with natural materials or painting. Strategic material craftsmanship, and structural components can be used to arouse curiosity and invite people to explore the setting, particularly to attract more men visitors as observed in the study. In any case, the surface materials should be warm to the touch, and plastic materials should be avoided.

In contrast to the usual clinical healthcare settings, the designers should aim for vibrant, high-contrast, quirky, colourful spaces. According to the analysis in this research, colourful decoration gives a sense of family and floods people with feelings of welcome and relaxation. Moreover, different spaces with different colours help people to look from a different perspective.

Within the setting, designers can use vernacular elements from material to furniture choice. The inclusion of local and traditional architectural traces and elements from 'home' culture of the local users will strengthen a sense of familiarity and a sense of belonging, which contributes to welcoming and relaxing feelings. In order to create a homely environment, the designers should understand very well the local people's own perception of what home means, as they will be the main user group and the notion of family and home culture depends on the context in which they grew up. Besides, nature-based smells and sounds should be used while avoiding chemical medicine-like fragrances and sounds, because the multi-sensory experience has a striking impact to help people to create a connection between their memories and space. This should be taken into consideration that, as it was clearly detected in this study, combining both familiar and relaxing domestic features that makes the people feel safe and homely with surprising and stimulating features will attract people by curiosity.

Lastly, the space should offer a sense of protection and refuge, as the user groups will mainly be vulnerable patients or their relatives. Façade openings can be designed following the prospect-refuge principles, in which the main idea is "see without being seen". View angles can be arranged in this regard, and be supported with greenery and plants in the garden. Screening on some windows or curtain systems can also be implemented.

7.3.5. Consultation Rooms

The consultation rooms are the places where direct psychological therapy is delivered. The position of seats should maximise the view from windows to allow patient and psychologist to give visual breaks and time to think whenever they need since the topic sometimes can be intense and they might need a relaxing focus. These rooms work in a kind of similar way to the specialist care units investigated in Chapter 4, therefore, seats near the window were also regarded there as the most commonly preferred location within the treatment rooms, in which optimum daylight and uninterrupted views for a larger portion of the room were sought. Moreover, as learnt from the systematically searched review, cancer patients seek a spacious calm atmosphere while consulting with a doctor, nurse or specialist.

7.3.6. Outdoor Settings

The importance of easy and effortless physical access is frequently emphasised in the studies in Chapter 4. Thus, porches, courtyards, patios, balconies, terraces and gardens can encourage easy connection with the outdoors. However, it is important to consider a balance between shaded and sunny areas and use adequate greenery and comfortable amenities.

Garden design should reflect nature by avoiding artificial or over-designed features. The variety of plants creates a sensory richness and encourages people to enter and discover the settings. Also, various plants reflect seasonal changes and transform the atmosphere every day. Gardens should be enriched with diverse plants and flowers to heighten and uplift the senses. Also, wilderness such as birds, bees, or small animals, can be attracted or owned to trigger all senses: the smell of scented plants and blossoms, the tactile texture of the tree trunks and sitting on the grass, hearing rustling leaves and rain's pattern on the leaves, hearing the singing of birds that perched on the trees and chickens crowing, or the taste of edible plants and fruits and so on. Water features, particularly running water, are also a very useful tool to create a calming restoring sensory environment. A well-designed pool or fountain can easily promote the environmental quality of the gardens.

Moreover, in an urban context, plants can be used as a buffer zone around the gardens to create a quiet refuge and a breathing place between the setting and the outside world.

A glass house or winter garden concept can be integrated into the setting, which can become a distinctive characteristic of the centre, where the users can enjoy diverse vegetation in any season and a multisensory environment, and are involved in activities to grow plants. This concept can help to improve spatial and biophilic quality as they offer easy access to natural elements to users, particularly those who do not have enough power to walk out, in all seasons. Regarding patients who might be sensitive to cold weather, this kind of sheltered space can confidently offer contact with natural features such as daylight, fresh air, greenery, and a multi-sensory environment. Additionally, the production of plants and vegetation in these greenhouse-like spaces can also contribute to the setting's social opportunities.

Another point staff indicated is that they sometimes they need privacy, particularly, an opportunity to have separate outdoor options for staff to which visitors do not have access would increase the speed of refreshing during the breaks.

Lastly, experts supposed that including physical exercise opportunities (regarding patients' physical ability) can also be helpful for their mental state such as stroll gardens, walking paths, meandering trails and resting points, mobility and balance training, gardening tasks, assisted walking and labyrinths.

7.3.7. Designing from a Staff-Centred Perspective

The systematically searched review in Chapter 4 revealed that easy access to private and quiet spaces, such as break rooms or outdoor settings shielded from inside views, where they should also be able to enjoy adequate daylight and thermal comfort, are the most desired environmental features by healthcare staff. These needs have also been identified clearly in Maggie's centres. Staff break areas should be located in ways that provide easy and rapid access back to patients, and also to outdoor spaces which appears to be one of the most critical applications of biophilic design for staff wellbeing. Although staff want to have private spaces, they still strictly indicated that the best withdrawal space should allow a one-way visual connection with patients to keep an eye on them, thus, they can rest and relax comfortably. The general idea of a desirable indoor break area location follows the same concern, easy and rapid access to patients.

View through windows is a frequently desired feature within staff indoor break areas, since visual or physical contact with the outside world and biophilic elements (e.g., View, Prospect, Daylight) played a critical role in staff's restoration. In fact, the most powerful stress reliever was found to be the provision of direct access to the outdoors, because of the opportunities to direct contact with natural elements.

A homely environment is recommended in break areas, where a sensorial connection with nature could provide a relaxing environment to reduce stress. The furniture in break areas should be easily rearrangeable, and comfortable, for individual and group activities, with sofas and recliners.

Given that refuge and quietness are the most important biophilic parameters for staff, designers may think of private outdoor break areas free from patients and their companions where the environment is enriched with greenery, trees, shade, tables, flowers and water features.

7.4. Concluding Remarks

Having established a biophilic design framework and guidelines specific to therapeutic environments in this chapter, the biophilic assessment of therapeutic environments is possible by considering the criteria defined in the chapter. Moreover, designers can follow recommendations and the guidelines defined in this chapter to design more efficient biophilic therapeutic environments for users as the general definition and standards of being biophilic were framed from users' perspectives.

The following chapter will conclude this thesis by explaining the importance of this research and its findings, limitations, and recommendations for future research.

CHAPTER 8

8. CONCLUSION

The examination of the current practice of biophilic design from the three different perspectives reported in Chapter 1 (scientific research, architectural practice and regulatory frameworks, and standards), revealed that there is no holistic systematic framework that defines borders and provides enough specificity for each building typology and climatic and cultural context. This, in turn, implies that current frameworks do not enable designers to be efficiently guided through a clear path. Therefore, this study aimed to assess the importance of biophilic design in therapeutic environments and provided a novel conceptual framework that can more efficiently guide designers and policy in future interventions in therapeutic environment design. The premise of this research was that a rigorous design framework should include synthesised analysis from clinical and non-clinical environments, primary data obtained from a mix of qualitative methods, and it should be benchmarked against objective scientific data about the impact of biophilic design on humans. This objective and subjective analysis of each of the biophilic design parameters was investigated in this PhD research and provided a comprehensive discussion and complement guidance.

This study claimed that existing biophilic design frameworks fail to provide efficient guidance since their design recommendations do not differentiate the level of value of each design parameter for each building programme and context. Thus, my position was that a biophilic design framework can only be efficient if it is adapted to specific building functions and is geographically and culturally contextualised. So, to be able to provide efficient design guidance, it was necessary to determine a selective hierarchical structure for each context, as specific parameters from within the established general frameworks become especially relevant for the users.

As explained in Chapter 2, there are three main original biophilic design frameworks. The framework in *Dimensions, Elements and Attributes of Biophilic Design,* of *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life* (S. Kellert et al., 2011) superficially examined the biophilic design elements regardless of the applicability to design practice. Also, the framework did not specify any building typology or did not demonstrate any comparison between different parameters. Kellert's second framework, *The Practice of Biophilic Design* (S. Kellert & Calabrese, 2015), was more organised and more focused, and also systematised biophilic design parameters in a more comprehensible way to inform the application of design practice. However, this framework was also not specific to any building typology, and the importance level of each parameter was still missing, hence, it did not guide designers in a clear way on how to consider their design is efficiently biophilic.

Another framework, the most commonly used in research and practice, described in *14 Patterns of Biophilic Design* (Browning et al., 2014), considered biophilic design parameters in an interdisciplinary context. This book was fundamental in providing a more comprehensive framework to define and assess design based on biophilic principles. The classification was supported by empirical evidence and addressed the parameters that were supported by more empirical data, although it was not ranked by importance level. So, this framework aimed to be flexible and adaptable for practical use in the application or development of biophilic designs due to their more exact definitions than in previous frameworks. However, the framework was not able to address which parameters are more critical according to building typology or context, although the parameters were scientifically examined. Also, it listed scientifically supported recommendations to inform general design practice. Nevertheless, the recommendations were general for biophilic design applications, with no specification for each building typology. Following this framework, a design guideline, *Nature Inside: A Biophilic Design Guideline* (W. D. Browning & Ryan, 2020), explained the economics and design steps for the biophilic design process and examined case studies of applied biophilic design regarding different building typologies: housing, schools, retail, offices, hotels, hospitals, factories, and communal spaces. However, the guideline did not direct designers on a clear path, although it presented successful examples.

In comparison to the previous frameworks, this thesis presented a biophilic design framework specifically developed for therapeutic environments and specific to non-clinical typologies in the UK context (Table 8-1). The criterion for biophilic buildings was clearly stated by hierarchising biophilic design parameters based on the user groups' requirements. For example,a designer cannot claim a space as biophilic design if the space does not employ even one of the parameters represented in Group A, which represents *extremely important* parameters, or designers should employ all the parameters in Group B, which represents *very important* biophilic design parameters, nevertheless, they can be disregarded only if experts prove that environmental conditions are unfeasible or the application of a parameter in this group can be harmful to some users. Therefore, the new conceptual framework directs designers and more precisely draws the borders of biophilic design, in contrast with some practice that uses biophilic design as a self-promoting tool, employing an insufficient and inefficient application of biophilic design parameters. The new framework was also supported by design recommendations from general principles to specific recommendations for spaces in therapeutic environments that will guide designers to fulfil required biophilic design features. Therefore, the proposal of this new conceptual framework answers the main research question of this doctoral study: *Which biophilic parameters are critical in the design of a therapeutic environment, and how can designers implement them adequately in their designs within the limits of a holistic scientific and regulatory framework?*

Table 8-1: Comparison of the existing biophilic design frameworks and the new conceptual framework.

Existing Biophilic Design Frameworks and Guidelines				**The New Conceptual Framework for Biophilic Design in Therapeutic Environments**
Dimensions, Elements and Attributes of Biophilic Design	**The Practice of Biophilic Design**	**14 Patterns of Biophilic Design**	**Nature Inside: A Biophilic Design Guideline**	
General to all typologies	General to all typologies	General to all typologies	General to all typologies but with examples of different typologies	Specific to non-clinical therapeutic environments
Unnecessary categorical division and insufficient definition of parameters	Adequate definition of the parameters	Adequate definition of the parameters	No definition of the parameters	Adequate definition of the parameters
Slightly supported by scientific knowledge	Moderately supported by scientific knowledge	Supported by scientific knowledge	Moderately supported by scientific knowledge	Fully Supported by scientific knowledge
No reference to cultural or regional characteristics	No reference to cultural or regional characteristics	No reference to cultural or regional characteristics	No reference to cultural or regional characteristics	Based on the UK context: Western culture and humid temperate climate
No indications of an order of importance for parameters	No indications of an order of importance for parameters	No indications of an order of importance for parameters	No indications of an order of importance for parameters	Hierarchised and standardised recommendations, based on order of importance in the use of parameters
Very rarely included guidelines for practice	Occasionally included guidelines for practice	Included general guidelines for practice	Included guidelines for practice based on specific examples	Included detailed general and specific guidelines for therapeutic environment practice

On the way of answering this question and fulfilling research objectives, firstly, a narrative literature review was carried out to support scientific evidence in terms of the biophilic design discipline as investigated in research practice, as used in design practice, as established in regulations and standards, and in a healing environment and relevant theoretical premises and approaches that support physiological, psychological, and emotional health in therapeutic environments. The literature review also profoundly contributed to exploring the benefits of connecting nature and natural elements with scientific facts that informed the framework and design guidelines for therapeutic environments. Furthermore, tracing the evolution of healthcare environment design through a historical background gave insight into the consequences of interventions and the current state of healthcare environments. Therefore, the establishment of a conceptual foundation of common therapeutic building typologies by signifying spatial characteristics and user groups served as a layout for further investigations and analysis. Apart from the narrative review of academic literature, a grey literature review gave an insight into the demands of patients and required environmental features of healthcare settings from reports and contributed to the research by revealing keywords and practical questions that were used in the interviews.

The systematically searched review also provided scientifically reliable and less-biased insight into the importance of the biophilic design elements in clinical environments from peer-reviewed journal papers. The systematically searched review followed rigorous replicable peer-reviewed steps and systematically identified nine studies that helped to identify and rank the biophilic design parameters that appear the most critical for promoting and supporting human health and well-being in clinical therapeutic environments, from the user's perspective. The results showed that biophilic design parameters in clinical environments cannot be examined under one umbrella concept, but the assessment should be specific to each space based on user groups. Although this research mainly focused on the non-clinical environments, this review provided insight into cancer patients' and staff's needs and indirectly supported the data from the non-clinical Maggie's centre focused parts of this research as well as provided benchmark information for future research and design guidance in these environments.

The meta-synthesis contributed to this study by systematically identifying, comparing and synthesising all published qualitative literature on Maggie's Centres. This methodology helped to investigate Maggie's Centres' architecture, from the users' and the designers' perspectives, assessing their experiences in these buildings and their design intentions from previous qualitative research on these centres which were conducted from different standpoints. Thus, this great amount of qualitative data exists within the published body of research, and they have been analysed through a biophilic lens in this research. The systematically selected data helped to identify and rank the biophilic design parameters that appeared as the most critical for promoting and supporting human health and wellbeing in non-clinical therapeutic environments, from the user's perspective. Therefore, the critical biophilic design parameters were classified into four main groups in order of importance. This classification took its final form in the new conceptual framework with the support of data from semi-structured interviews and the narrative literature review. The meta-synthesis study also offered a compilation of distinctive design interventions related to biophilic parameters, which provided benchmark information for future research and design guidance in non-clinical therapeutic environments.

Following the data compilation from existing literature, semi-structured interviews with experts and practices enabled the collection of a set of information from practice and supported and enriched scientific evidence with experience-based knowledge, verified the results obtained from a systematically searched review and meta-synthesis studies by crosschecking the results from primary sources. These interviews also supported and expanded the results based on the recommendations of the experts and practitioners. The interview results provided a larger scale of information about therapeutic environments, as many of the architect participants were involved in both the design of clinical settings or hospitals and the design of Maggie's Centre. The studied Maggie's Centres were selected based on various key features that the study wanted to contrast: urban versus rural settings; use of low-key resources versus non-restricted design; employment of special materials, gender-friendly explorations, as well as presenting a variety of early period centres and recently designed centres. In the new conceptual framework, the most prominent contributions from the interviews were that they clarified the importance of some parameters that appeared with a more ambiguous role in the existing literature (such as Water in non-clinical settings), offering a set of recommendations for decision-making and design process, and contributing to design recommendations to inform design practice in both clinical and non-clinical environments.

Moreover, this thesis proposed a guide for biophilic design applications in non-clinical environments with a particular focus on cancer patients. The guidelines were mainly shaped around the needs and problems of cancer patients. The recommendations followed their physiological needs (i.e. recommendations regarded various side effects such as sensitivity to cold or smell by offering patients control over the thermal variability or fresh air, access to sunlight, furniture with natural material to prevent over-heat etc.) and psychological needs (socialising opportunities, more private refuge spaces, relaxing and calming indoor and outdoor spaces with natural elements, offering visual focuses with nature view or daylight to distract unpleasant thoughts etc.). Although the existing regulations and standards examined in Chapters 2 and 3 emphasised the importance of natural light, view, fresh air, thermal comfort, access to natural spaces and privacy, they do not specialise in biophilic design and specific populations and do not indicate biophilic parameters directly but use biophilic values as criteria among the many other non-biophilic features. On the other hand, the guidance in this thesis proposes a clear frame for biophilic design applications (in which designers know how to classify their spaces as biophilic), in a specific typology (non-clinical therapeutic environments) for a specific population (those affected by cancer) in a specific climate (humid temperate oceanic climate) and specific cultural context (western culture in the UK) in accordance with my positon to the biophilic design's definition.

To sum up, based on my findings in these studies this thesis proposes a new definition of biophilic design that will reduce misunderstandings in practice, application of regulations and research environments: Biophilic design is a harmonious reflection of natural parameters that work together in order to make the users feel the connection with nature with all aspects. All biophilic design parameters cannot be equally important for every type of building, this harmony should be established for a particular type of building regarding the particular type of climate and local culture since people have different notions of nature and perceptions of nature.

As explained in Chapter 7, the research question has been answered by proposing a new conceptual framework with design guidelines, which took shape based on the data obtained from the four main methodologies of this research: the narrative literature review, the systematically searched literature review, the meta-synthesis, and the semi-structured interviews with experts and practitioners.

8.1. Limitations of the Research

The main limitation of the research was the COVID-19 outbreak and subsequent relevant restrictions that took place in the UK since March 2020, which was the second year of this doctoral study. Having set up the methodological approach for qualitative field studies (semi-structured interviews with patients and staff, focus groups, and ethnographic observations) and obtained ethical permissions to collect data from human participation (including vulnerable participants), all on-site case studies were cancelled by the University of Liverpool Senior Management Team from 19.03.2020 to 12.10.2021. Therefore, all case studies had to be remotely investigated. However, the remote data collection from user groups of a selection of buildings, which included case studies from NHS-affiliated institutions and Maggie's Centres, was not possible during such an extraordinary period. It was immediately impossible for such a strained moment for the NHS to be involved in the study. Likewise, the Maggie's Centre Research Advisory Group, after developing a customised research plan with them for months, ultimately stated that Maggie's Centres were not in a position to support any research during the pandemic, due to the majority of their staff being on furlough. They suggested to meet again a year later to reassess the situation, but that would not be feasible within the PhD timeframe.

Therefore, the alternative determined method was to collect the data that will answer the research question from the existing body of research, which included interviews, focus groups, observations and questionnaires (users' views), but had been conducted from a different perspective and was yet to be analysed through a biophilic lens. Hence, another limitation emerged as the existing studies did not intentionally seek answers for biophilic design applications, therefore, some parameters were not found as directly referred, so they were extracted by gaining deeper knowledge about the biophilic design and parameters to include in the ranking. On the other hand, this limitation was also beneficial to produce less biased claims in the framework, since the participants were not asked for information about biophilic design as researchers might unintentionally direct them to speak about some biophilic design parameters that were not important for the participants.

Additionally, it was noticed that the available case studies about biophilic design and healthcare environments were limited in number. Also, the employed studies were mainly localised in industrialized Western countries and typically were of less than high methodological quality. Climate and culture influence human perceptions of nature, so as more research is conducted in various regions, climates and cultures, a wider range of data will contribute toward more effective localised biophilic design frameworks. However, as the framework in this study aimed to be produced for the UK context, the selected studies were able to inform this research.

8.2. Opportunities for Future Work

This research was conducted specifically in the UK context so that humid temperate climate and Western culture were the main contexts of this new conceptual framework. As stated above, climate and culture influence human perceptions of and relationships with nature, thus, more research about the application of biophilic design in therapeutic environments in various regions, climates and cultures is necessary to contribute toward more effective localised biophilic design frameworks. For example, the application of biophilic design in healthcare settings located in extreme climates such as desert or tundra climates, where the application of some biophilic design parameters is challenging; in various cultures such as the Muslim culture, which attributes great importance to privacy;

or in highly industrial regions, where the inevitable pollution will play an important role in the connection between inside and outside.

In conjunction with this, this study also showed that inpatient, outpatient and staff users had similar desires but sometimes divergent priorities and requirements and that the provision of the same or similar biophilic elements to different groups could support distinct affordances. Thus, a biophilic design framework for clinical environments should be developed based on the types of illnesses even among the types of cancer, side effects, environmental perception of patients, and biomarkers changes. However, this kind of research needs a well-equipped team including experts in a variety of fields of expertise such as architecture, medicine, and psychology. Moreover, future research should investigate the different building typologies and programs based on their specific user groups and contexts, to provide efficient and rigorous biophilic design frameworks. This new conceptual biophilic design framework understanding can be extended to different typologies such as housing, schools, retail, offices, hotels, and factories as well.

The biophilic design concept is increasingly popular, and research in this area is markedly growing. Particularly after the COVID-19 pandemic, lockdowns and curfews, people comprehended how important it is to have a connection with nature and natural elements. Undoubtedly, the tendency to biophilic design will progressively increase in the near future in both practice and research. However, regarding the increasing urbanisation and 'concretion' as the number of concrete blocks has been increasing in rapidly growing cities, the biophilic design discipline should be more substantially introduced to the real world. Thus, researchers should seek clear routes to share their knowledge with practitioners, and policymakers should take biophilic design into their agenda in health and well-being-related regulations. Last but not least, designers and contractors should not exploit and corrupt the biophilic design concept for marketing purposes, since a sort of 'green washing' practice can be seen, which claims to apply biophilic design by just adding green walls or pictures of nature on a wall. In fact, these so-called 'biophilic buildings' have been increasingly advertised and this trend is likely to continue. Therefore, the definition of scientifically underpinned biophilic design frameworks specific to the context and each typology is fundamental in this discipline.

"Nature itself is the best physician"

Hippocrates

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Appendix

Interview Questions

Title: Human-Centred Therapeutic Environments: A New Framework for Biophilic Design

Ph.D. candidate: Bekir Huseyin Tekin
School of Architecture, Department Architecture, University of Liverpool, UK
Email: *B.Tekin@liverpool.ac.uk*

Questions for Designers (Architects)

Do you have any knowledge about biophilic design theory? If so, have you considered biophilia in the design?

How did you consider the Maggie's design guidelines in the design process?

Could you please explain your design intentions and consideration of the human-nature connection in the spaces?

Was the design process for this project the same as in other projects, or did you follow a different process?

How was the management and communication with Maggie's?

Did you do any research for this project or any readings that were particularly influential?

Did you collaborate with any specialist consultants?

How did you approach site analysis/context in this project?

What were the main design aspects or drivers behind the project?

Have you done any post-occupancy monitoring to confirm your design intentions?

What underpinned/informed your material choices?

Did you have any other conversations with any other key stakeholders or who else contributed to the project?

Can you explain design considerations in relation to light, garden, view, comfort, sensory experience, colour, public/private spaces?

Based on post-occupancy observations, is there anything in the design that you think you should have design differently?

In terms of clinical environment design, which kind of environmental features do you think provide a healthy environment for patients and staff?

How can designers create the best connection with nature in clinical settings?

What are the differences and challenges between the clinical (hospital) and non-clinical (Maggie's) environmental design processes?

Interview Questions

Title: Human-Centred Therapeutic Environments: A New Framework for Biophilic Design

Ph.D. candidate: Bekir Huseyin Tekin
School of Architecture, Department Architecture, University of Liverpool, UK
Email: *B.Tekin@liverpool.ac.uk*

Questions for Experts (Staff)

Introduction about Maggie's Centres' architecture

The building form is aimed to be designed to attract people: the idea is that the striking architectural forms can have an impact in encouraging visitors to take that first step to visit the centre, entering the building should be a meaningful moment and also for them to forget for a few minutes about their own problems as they immerse in a special space, in which many visitors report to feel welcome and safe.

1. In terms of first impressions and the building's impact, what do you think have **been the most successful elements** in the buildings you work, the most special? What is what visitors make more comments about?

Has this impression changed during the COVID-19 restrictions? (

Prompt: What I mean is, part of this can certainly be attributed to the building design, but also to the atmosphere that staff generate in the space, which is now different.)

What do you think the people who **received therapy in the building in a limited way** due to these restrictions miss the most about using the building?

What do you think the people who **have been given remote therapy** as a result of the restrictions after the COVID-19 pandemic might miss the most about not being in the building?

2. **In which ways** does your building impact visitors the most? In which ways does your building impact staff the most?

3. (We'd like you to take a photo of your favourite part of the building before the meeting so you can give your opinion on it) Can you describe your favourite corner/part of the building and tell us why you like it?

Do you think that this preference is shared by other members of staff?

4. **When planning where to allocate different activities**/parts of your programme **in the different spaces** of the centre, which qualities of the space do you take into consideration?

Do you feel that the space is flexible and versatile, or **do you feel that each** corner/area **has specific** values/**identity that is best to keep as this benefit specific activities**?

Do you find it easy, convenient, efficient, comfortable for the different work tasks?

5. Do you think there are design qualities that one can appreciate **only after using the building a lot**? Are there any functional qualities that you think you (people who work here) can appreciate from the building that visitors don't get?

6. At Maggie's, the staff are perceived to be more invested in looking after the visitors. Visitors appreciate that there is no reception desk, the staff cannot hide behind a computer to do their own thing; they feel personally welcomed and attended. **Do you keep discussing**/evolving **this interaction with visitors in connection with the way space should be used?** We are wondering if there is a 'protocol' that keeps being revisited, or if this 'protocol' is bespoke for each building and gets reviewed for new buildings?

7. Part of Maggie's brief is to provide a **connection between inside and outside/nature.** Which parts of your building are more successful in providing this connection to nature?

Based on your observations over the years, **how would you interpret the relationship of your visitors to the building's natural elements?** For example, do they usually prefer to establish a visual connection with the outdoor space where they spend time indoors? Have you noticed an improvement in their therapy or a significant decrease in stress levels when they go out to the garden or establish a connection with the outside space?

8. How would you **describe the atmosphere** of your centre? (PROMPT: Is natural light important?)

9. As far as we know, women visit the centres significantly more than men (overall 34%). Do you think there are differences in visitors depending on gender? **What are the reasons in your point of view?**

10. Regarding the sensory experience;

What role do you think other sensual perceptions (sound, smell, tactile experience, taste…) play in the **identity of Maggie's**?

Do you think this sensorial atmosphere has changed during **covid-19 restrictions**?

What is **the impact of these sensations** based on your experience?

Do visitors show a **tendency to spend time** where they can get more air or a warmer space (by the fireplace) as a special environment?

11. Have you observed **a seasonal chang**e in visitors' visits to the building and their **length of stay** or **the way they use the spaces**? For example, those who like to spend more time in the centre because the building gets better sunlight in winter, or the tendency to spend more time in good weather in the garden of the building or in the spaces that have a visual connection with the garden.

Appendix B List of Publications and Conferences

Tekin, B. H., Corcoran, R., & Urbano Gutiérrez, R. (2021). A New Reading of Therapeutic Environments: Biophilic Elements in Maggie's Centres. *The 8 Th International Conference on Architecture PROCEEDING The 8 Th International Conference on Architecture and Built Environment with AWARDs*, 289–298. www.s-arch.net

Tekin, B. H., Corcoran, R., & Gutiérrez, R. U. (2023). The impact of biophilic design in Maggie's Centres: A meta-synthesis analysis. *Frontiers of Architectural Research*, *12*(1), 188-207. https://doi.org/10.1016/j.foar.2022.06.013

Tekin, B. H., Corcoran, R., & Gutiérrez, R. U. (2023). A Systematic Review and Conceptual Framework of Biophilic Design Parameters in Clinical Environments. *HERD: Health Environments Research & Design Journal*, *16*(1), 233-250. doi: 10.1177/19375867221118675

Tekin, B. H. & Urbano Gutiérrez, R. (2022). Healing Architecture: A Review of the Impact of Biophilic Design on Users. PLEA 2022 - *Will Cities Survive? Proceedings of the 36th International Conference on Passive and Low Energy Architecture Santiago, 22 November 2022*

Tekin, B. H. & Urbano Gutiérrez, R. (2022). Disentangling the Mass Health Machine: A New Conceptual Framework for Biophilic Healthcare Design. SPACE International Conference 2022 on Architectural Design and Theory *London, 24-25 November 2022*