

Cultivating The Vision: Advancing Biophilic Design through Innovative Education

text and images by
Park Hye Young
Tham Xin Kai
Bronwyn Tan
Kuan Chee Yung
Pauline Ang
Agnieszka O. Guizzo

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Urban living, influenced by factors like building densification, climate change, and the increasing loss of green spaces, can significantly deteriorate the quality of living, societal dynamics and physical health. It underscores the crucial significance of both exposure and the diverse range of green spaces in mitigating various urban living challenges (Urbact 2022; Olszewska-Guizzo et al. 2022; Peen et al. 2010). The expanding body of scientific studies reinforces the idea that exposure to nature in urban settings significantly enhances mental health, reduces stress, boosts productivity, and contributes to an overall improvement in quality of life (Beute et al. 2023).

Lei et al. (2021) discovered the positive impact of the presence of greenery on physiological brain activities. Additionally, in a Singapore study, Olszewska-Guizzo et al. (2022) found that therapeutic gardens with certain contemplative features can support the treatment of depressive disorders, the most common mental illness worldwide. Similar stress-reducing benefits associated with the presence of plants and natural views were emphasised in research on salutogenic workplace settings (Bergefurt, Appel-Meulenbroek, and Arentze, 2023) (Fig.1). In this context, the philosophy of biophilic design becomes especially relevant by recognising and embracing the inherent human connection to nature. It advocates for designers to intentionally integrate natural elements into the built environment, strategically reconnecting people with the natural environment.

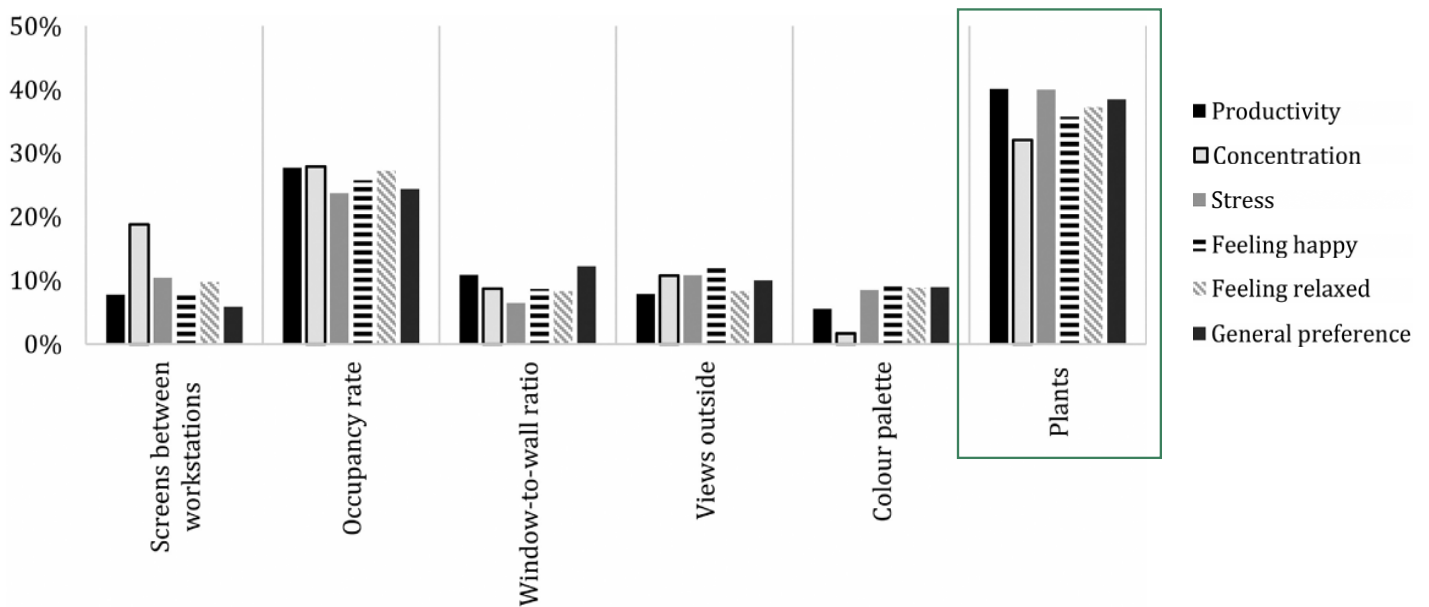


Fig 1. Relative importance of workspace attributes per psychological or cognitive response. (Source: Bergefurt, L., R. Appel-Meulenbroek, and T. Arentze, 2023.)

New research supports the measurable, positive impacts of biophilic design on human health, strengthening the empirical evidence for the human-nature connection and raising its priority level within both design research and design practice (Downton et al. 2017). Despite advancements in comprehending these effects, it is evident that practitioners still encounter challenges in translating research findings into practical applications, hindering the broader advancement and diverse application of biophilic design.

Hence, Nanyang Academy of Fine Arts (NAFA), one of the founding members of the University of the Arts Singapore (UAS), recognised the pivotal role of education in advancing professional training in biophilic design, amplifying the synergy between research and practical application.

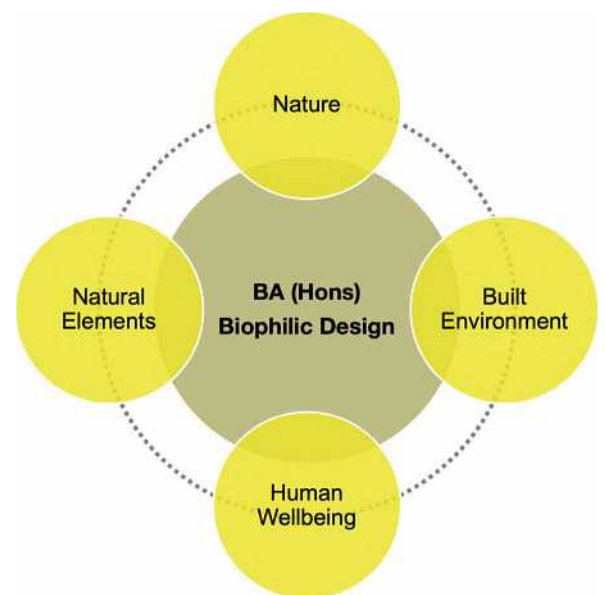


Fig 2. Curriculum Focus

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The exploration extends to urban ecology and regenerative design, highlighting the symbiotic relationship between the built and natural environment.

The program places a strong emphasis on evidence-based and nature-centric solutions, promoting collaborative approaches through interdisciplinary practices that transcend singular disciplinary perspectives.

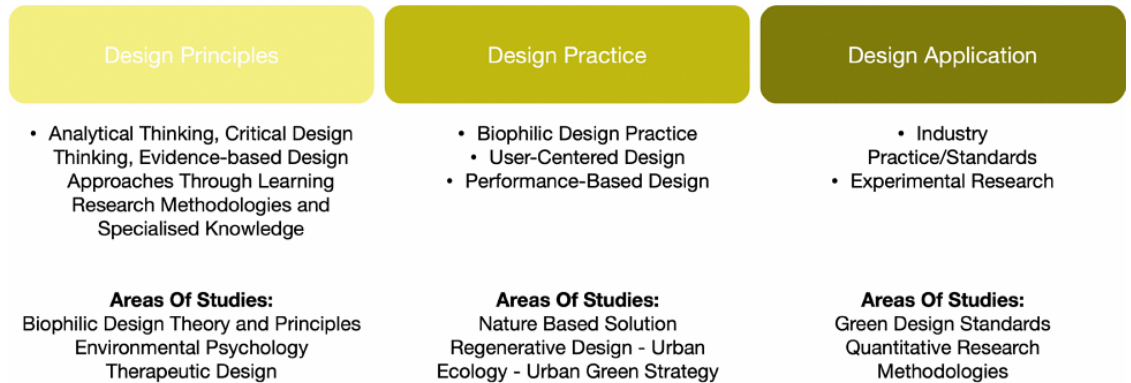
The subsequent sections delve into current biophilic design practices, the neuroscience dimension in biophilic design, the intersection of design with health and well-being, and the importance of interdisciplinary collaboration. The exploration extends to urban ecology and regenerative design, highlighting the symbiotic relationship between the built and natural environment. These discussions are instrumental in shaping the curriculum structure and guiding the integration of knowledge and practice necessary to advance a holistic approach to biophilic design.

Current Biophilic Design Practice

The original concept of biophilic design, an emerging field pioneered by Yale social ecologist Stephen R. Kellert, promotes improved health and well-being by creating connections between people and nature in the built environment. This field has been broadly categorised into different nature-inspired disciplines, encompassing Nature-based solutions like Bio-utility, Natural Forms exemplified by Bio-morphism, and Nature’s Technology, represented by Biomimicry. However, a more precise definition posits that Biophilic design essentially serves as a branch devoted to addressing Bio-Psychology wellness (Jain et al. 2023).

Many Architectural, Urban Planning, Landscape, and even Interior Design practices claim to have incorporated Biophilic Design into their proposals. Some use the ‘14 Pattern of Biophilic Design’ by Terrapin Bright Green LLC (Browning, Ryan, and Clancy 2014), Kellert’s ‘24 Biophilic Design Strategies’ (Kellert et al. 2015) and others use various features and qualities of their own derivation. The current approach to biophilic design lacks organisation and scientific rigour, making it subjective and complex. This makes it challenging to standardise the evaluation of achievable levels of wellness.

Fig 3.
Course Structure



In acknowledgement of these challenges, the degree programme addresses the necessity for a robust foundation in understanding how the design of physical spaces influences human cognitive functions, emotions, and overall well-being. This involves advancing the operational framework and scientific precision essential to the field of biophilic design, transcending theoretical discussions to actively engage in systematic analysis of user feedback data. Through this dual focus on foundational understanding and empirical analysis, the programme aims to enhance the scientific rigour and effectiveness of biophilic design practices.

Neuroscience Dimension in Biophilic Design

Typically, when distant disciplines come together, there are certain challenges and barriers to overcome. In order to inform the design of the living environment with scientific findings, the areas related to human health and well-being had to be incorporated into the research and design protocols. For more than a decade, we have observed a blooming interest in science-informed design in various sectors among different stakeholders, with multiple attempts to marry the art and science in an endeavour to create healthier living environments. As an effect,

many theories and concepts are being developed and many guidelines and principles established, some are more and some less valid and grounded in science. We are living in interesting times when knowledge about the design for health is being created and new gold-standards are being established. The amount of research attempts and publications, buzz-words and theories might be puzzling, and it might be difficult to select the most valuable insights for design. This is why it is very important to provide a comprehensive educational guideline through the recent scientific developments in the area of biophilic design and to guide future designers (architects, landscape architects, urban planners and interior designers) through the nuances of scientific research. This is to allow them to critically assess the knowledge, and extract the most useful information from the ongoing buzz.

Environmental psychology is the main pillar of the biophilia hypothesis. Environmental psychologists have already been gradually applying more sophisticated and robust methods, such as cognitive and functional neuroscience to inform the design practice for some years, but the knowledge in that area has not been synthesised and taught in academic courses before. The data about people's momentary mood, cognitive performance, sleep quality, long-term well-being among other self-reported measures have been a good source of information about the quality of environment and people's realised needs. The physiological data from people's brain activity, heart rate or stress levels can provide even more nuanced information about the processes that people might be unaware of in their day to day. Biophilic design education cannot come without the strong basis in the science of how environment can affect the human psyche and human brain.

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Design for Health and Well-being

According to the United Nations Department of Economic and Social Affairs, 55% of the world's population now lives in urban areas, and by 2050 the percentage will increase to 68% (UN DESA 2018). The increasing pressure of people living in urban cities away from rural areas continues to compromise the vital connection that people have with the natural environment and its benefits to our health. The World Health Organisation (WHO) states that health is the state of being physically, mentally, and socially well, rather than just the absence of disease or illness ("Health and Well-Being," n.d.). Conversely, individuals and societies experience well-being as a positive state of mind ("Promoting Well-being," 2021). Similar to health, well-being is a resource for daily life and is determined by social, economic, and environmental conditions. The concept of biophilic design can allow for a conscious effort to re-integrate nature back into our living spaces by stressing its benefits to improve health and well-being. Over the years, many research studies have been conducted to support this. One important paper is the "*View through a window may influence recovery from surgery*" by Environmental Psychologist Roger S. Ulrich in 1984. In this seminal research, he recorded findings that post operation patients whose rooms included windows that looked out to natural settings recovered faster than those without windows (Ulrich 1984).

In general, incorporating built environment with greenery serves as important spaces for people and their living environment. However, there has also been an increased demand for design interventions to cater to the needs of specific users. Here, biophilic principles can influence the design of therapeutic gardens, which are purpose-built spaces created to serve specific needs of various population groups, including seniors and children, physical or cognitive disabilities, as well as other socio-emotional conditions.

While considering the infrastructure of such spaces is important, it is also vital to examine how spaces can be utilised to promote healing. In recent years, there has been increasing use of nature-based interventions (NBI), particularly those that encourage people-plant connections to improve the well-being of people with diverse backgrounds and conditions.

NBIs, such as forest therapy and horticultural therapy, provide valuable insights into the design of biophilic experiences aimed at promoting health and well-being. These interventions involve structured activities with plants and nature to improve various aspects of an individual's life and condition. The impact of biophilic design extends beyond physical health to also encompass well-being. Built environments influenced by biophilic design approaches foster a sense of connection to the natural world, promoting health and well-being to various users for their physical, cognitive, and emotional needs.

Urban Ecology and Regenerative Design

The World Wildlife Fund has declared an average 69% decline in abundance of wildlife populations from 1970 to 2018 (WWF 2022) and the Intergovernmental Panel on Climate Change has warned that limiting global warming to 1.5 degrees Celsius compared to pre-industrial levels may be our last chance of avoiding irreversible damages to the planet (IPCC 2018). Faced with twin emergencies, what is the practical action for a practitioner?

Regenerative design provides an approach for establishing a partnership with nature by pursuing sustainability within the framework of living, evolving systems. It works on developing the capability of social and natural living systems, to express their potential for diversity, complexity and creativity (Mang, Haggard, and Regensis Group 2016). It aims not only to avoid negative environmental impacts but to restore and renew the environment. Like biophilic design, it can draw inspiration from natural systems, patterns and processes. However, unlike sustainable design, the emphasis is on prioritising systems which can regenerate or create positive outcomes for the environment, through a deep understanding of the interconnectedness of all things. For example, planting a food forest with an array of plant species does not only produce food for human consumption. Other benefits of a multi-culture include preventing soil erosion, creating shade to mitigate high ambient heats, fixing nitrogen, keeping soil well-aerated, providing improved air quality and providing refuge for fauna.

A slight shift in the focus from solely maximising food production to maximising long-term environmental benefits creates a holistic system which offers a lot more.

Urban ecology encompasses understanding the interactions of organisms, built structures, and the physical environment (Forman 2016). The challenges of the urban environment, such as flooding, heat stress, air pollution, loss of biodiversity habitat and connectivity can be approached by integrating ecological principles into the cities so that cities can be more liveable. The concept that the environment is dynamic and has to be performative allows us flexibility in spatial planning. At a landscape level, multi-functional water-sensitive urban design elements, multi-layered streetscape planting, skyrise greenery and urban forests provide ecosystems services such as temperature regulation, water detention, rainwater harvest and reuse while supporting urban biodiversity and giving urban dwellers opportunities for nature appreciation. On a planning level, an introduction of policies and infrastructure can support more sustainable modes of transport such as cycling reduce air pollution and reliance on fossil fuels while promoting a healthier lifestyle. On a regional level, considering nature-based solutions such as restoring mangrove forests can help to stabilise shorelines while capturing carbon.

As cities grow, biodiversity declines and environmental pressures continue to mount, building a synergetic and harmonious relationship between the built and natural environment is the only option. The most effective solutions are often those that work sensitively with nature, and this begins with biophilia.

Importance of interdisciplinary collaboration

The application of specific biophilic design strategies with targeted health and well-being outcomes is an important part of the biophilic design process that distinguishes a biophilic building from one that simply incorporates greenery or daylighting as isolated gestures. These outcomes can be translated into health or performance metrics that are already familiar to clients, such as shorter recovery periods for patients in a hospital, improved test scores in a learning environment, and increased productivity in a workplace. Defining performance in measurable terms helps to drive the design in a holistic way from an early stage, encouraging a more collaborative way of working amongst all stakeholders – which typically includes the client, end-users, multidisciplinary design team and other consultants – to achieve a common goal.

Meaningful results can be achieved if the process is organised in the form of a series of stakeholder charrettes that bring together the different user groups and design team to discuss and agree on the biophilic goals, strategies, and desired outcomes of the project. For instance, if one of the goals of an office renovation project is to improve employee engagement, a necessary first step will be to define what the baseline performance is and how the results will be evaluated quantitatively or qualitatively. From a Human Resources perspective, this may translate into lowering absenteeism or turnover rates; from an employee's perspective, it may mean having more opportunities for a range of formal and informal interaction with his bosses and colleagues. Methods of measurement often include pre- and post-occupancy surveys, which must be planned early.

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Having a clear idea of the desired outcomes for the project can help in the formulation or refinement of the programmatic brief, which describes the qualities that key spaces must have and sets the framework for a collective discussion on the biophilic design attributes that may be considered in those spaces. Where the goal is to improve workplace engagement, different types of gathering spaces may be defined in the brief, along with various use scenarios. Teams may choose to focus on biophilic design strategies that resonate with them, such as creating a distinct sense of place and encouraging curiosity and exploration, which may be expressed through colour, patterns, textures, lighting, acoustics, planting, artwork and furnishings for different group sizes and settings.

Terrapin's 14 Patterns of Biophilic Design frames biophilia as an essential component of environmental quality, along with well-established attributes such as daylighting, materials toxicity, air, water, and soil quality. This encourages design teams to develop cross-platform strategies that can address building performance, health, and well-being at the same time. Where biophilic design attributes that are conventionally seen as "aesthetic features" can be linked to building performance or a measurable health and well-being outcome, there is a greater chance that they will persist in a project. For instance, water features such as ponds and waterfalls can be conceived as part of a larger stormwater management strategy within a site, and sensitively designed to enhance biodiversity and create a cooler microclimate while promoting a sense of calmness.

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Through meticulous exploration of the symbiotic relationship between humans and nature, biophilic design emerges as a transformative force capable of fostering not only physical health but also mental well-being and societal harmony.

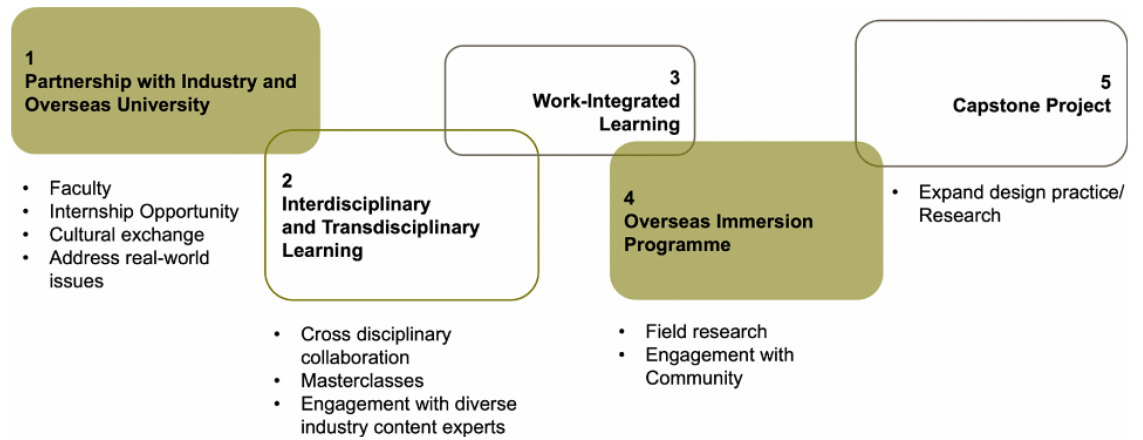
Conclusion

As we contemplate the future of our urban environments, the lessons learned from biophilic design extend beyond aesthetics. In the ever-evolving landscape of urban living, the imperative need for biophilic design becomes increasingly apparent. The focus on regenerative and evidence-based design propels us toward a harmonious coexistence with the natural world, recognising the intricate link between the health of our cities and the well-being of the ecosystems we inhabit. Through meticulous exploration of the symbiotic relationship between humans and nature, biophilic design emerges as a transformative force capable of fostering not only physical health but also mental well-being and societal harmony.

The University of the Arts Singapore (UAS) stands at the forefront of this transformative movement, leading the way in advancing the knowledge of biophilic design through innovative education. Conferred by the UAS, the new BA (Hons) Biophilic Design programme aims to cultivate designers capable of making a positive impact on shaping the built environment. The programme prioritises synthesising insights from diverse disciplines such as Architecture, Landscape Architecture, Interior Design, Urban Planning and Environmental Psychology to enhance the current practice, facilitating the collaboration between researchers and practitioners to cultivate a shared understanding of the nuanced complexities.

By seamlessly integrating research methodologies, design practice, and interdisciplinary collaboration, the UAS shapes a paradigm that not only prioritises evidence-based, nature-centric solutions but also bridges the gap between research and design practice. Through dynamic collaboration with industry and other overseas institutions, we cultivate a vibrant environment conducive to the development of cutting-edge insights and innovative practices, ensuring that our approach remains sensitive to the unique context of Southeast Asia. This effort offers solutions that nurture a healthful environment for individuals and communities, reflecting a dedication to realising the City in Nature.

Fig 4.
Distinctive Features



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