

Biophilic Design in Architecture

Ankur Gautam

University School of Architecture and Planning,
GGSIPIU, Dwarka, Delhi, India

“I go to Nature to be soothed and healed, and to have my senses put together.” – John Burroughs

Abstract *-Physical wellness, comfort and mental wellbeing are important factor in designing a built-form. We often neglect nature in process of design. Nature has no substitute. So, it is very important to consider while designing a building. Humans have evolved their behavioural mechanism & problem solving tactics responding to the stimulus from the surrounding spaces. Architecture, here, has an infinite power to dictate the character and stimuli generation of a space. This stimulus to be positively conceived and delivered physically, psychologically and intellectually to the surroundings, is the core of the Biophilic Hypothesis. This paper discusses the impact of biophilic design on human health and well-being and presents a unified framework for its application in the design of biophilic spaces.

Key words: *Biophilia, climate, design, nature, well-being*

I. INTRODUCTION

Originating from the ancient Greek (*bios: life; philia: love*), Biophilia describes the love for life and expresses the ethos of maintaining and developing the life of mankind in all

dimensions (physical, psychological, social, artistic, moral, etc.). Aiming to provide space for respectful and enriching relationship between human society and natural world, Architects have an opportunity to include this hypothesis into their design process.

II. BIOPHILIA IN ARCHITECTURE

We all know that there is no substitute of nature. Nature should be integral part of design. Closeness to nature in built-environment has a positive impact on the user. The potential of nature and built-environment correlation has not been tapped to the best of its limits.

Nature in built-environment can be incorporated in form of breeze, water features, gardens and aquarium. The strongest Nature in the Space experiences are achieved through the creation of meaningful, direct connections with these natural elements, particularly through diversity, movement and multi-sensory interactions. (Browning, W.D., Ryan, C.O., Clancy, J.O. (2014). 14 Patterns of Biophilic Design)

Nature in the built-environment can be defined in patterns mentioned below:-

| | |
|--------------------------------------|-------------------------------|
| P1: Visual Contact with Nature | P13: Mystery |
| P2: Non Visual Contact | P14: Risk/ Peril |
| P3: Non Rhythmic Sensory Stimuli | P15: Biomimicry |
| P4: Thermal & Airflow Variability | P16: Curiosity & Excitement |
| P5: Presence of Water | P17: Change & Metamorphosis |
| P6: Dynamic & Diffuse Light | P18: Security & Protection |
| P7: Connection with Natural system | P19: Attachment |
| P8: Biomorphic Forms & Patterns | P20: Attraction & Beauty |
| P9: Material Connections with nature | P21: Exploration & Discovery |
| P10: Complexity & Order | P22: Fear & Awe |
| P11: Prospect | P23: Reverence & Spirituality |
| P12: Refuge | |

Figure 1 Patterns of Biophilia.

For example connection with nature in any form direct or indirect reduces the stress level. Giving importance to sounds related to nature like sound of water or bird chirping over urban sounds improves the experiential quality for the user. Nature can be incorporated in direct form or by metamorphic i.e biomimicry way. Which means design forms which are inspired by nature or using textured which are derived from nature. It will make the use feel near natural environment.

Designing Biophilia Theories and Values, in form of a detailed framework is the need of the hour. The relationships incorporated within the structure of framework are based on themes, identified and studied within the literature.

Different variables such as typology of the project, site variables, scale and feasibility, domain of applicability of concept, occupant’s culture and demographics, effectiveness and efficacy of patterns, identifiable responses and outcomes, diversity of strategies, duration of exposure and frequency of access are applied at their consequent design stages amalgamate to yield a specific result, unique for each project, best explaining the framework as an effective solution for:

“...problem which occurs over and over again in an environment, and then describes the core path of solution in such a way, that you can use this solution a million times over, without doing it the same way twice”

The proposed framework sought to have an elaborate structuring of modified Biophilic patterns, strategies, as well as the qualitative aspects and variables influencing the relationship between domain of applicability and strategies for exposure to nature, with occupant’s health benefits. These in turn, affects the perspective for process of designing experiential spaces.

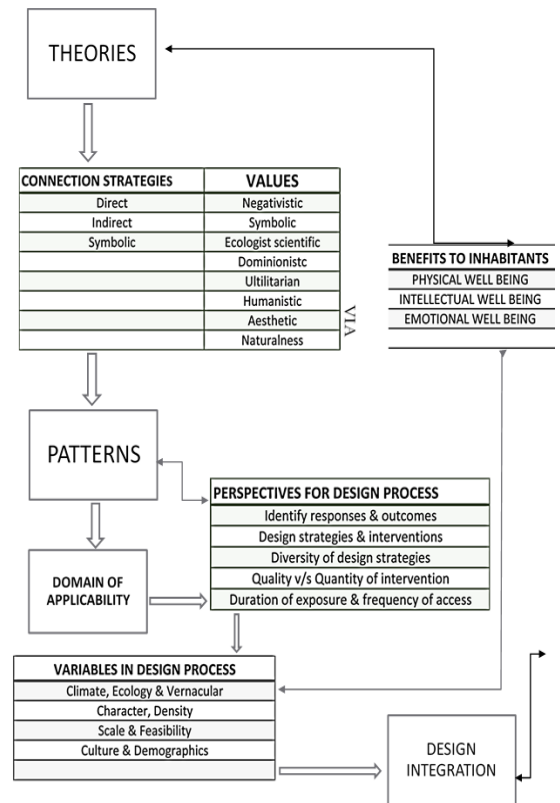


Figure 2 Framework for Design: Inter-relation of the themes arranged in specific order to be followed.

III. CASE STUDY

To access the generality of the proposed patterns and variables affecting their applicability, quantifiable subheads have been tested on institution site, depicting the outcome of the designed spaces having Biophilic essence: *Delhi Technical University, Bawana Road, Delhi*

The exposure to patterns are tested on criteria of site design, degree of exposure and frequency of access (Fig. 3). The illustration depicts the duration of access of campus spaces in terms of Landscape, Interior and Built spaces and the exposure of patterns in a space. Students are exposed to the benefits of the present patterns for greater duration in open spaces in DTU.

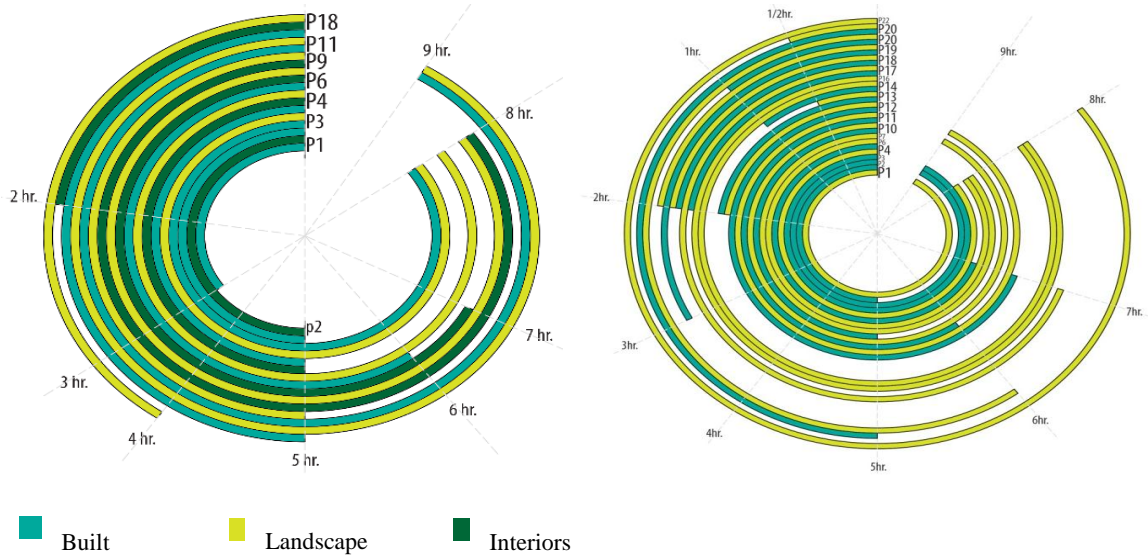


Figure 3 Duration of exposure:: Illustration depicting duration of exposure to a pattern in three different typologies of spaces:

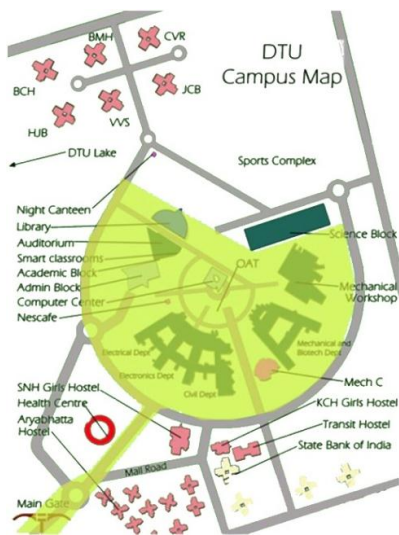


Figure 4 Site map of DTU showing areas analysed



Figure 5 : Venturi effect in DTU

| | | | | | | |
|-----|-------------------------|-----------------------|---|---|--------------------|--|
| P12 | REFUGE | P1 P11 P18 |  | Spaces with weather & climate protection, speech & visual privacy | BUILDING LANDSCAPE | <input type="checkbox"/> Providing level difference of spaces <input type="checkbox"/> Well shaded spaces <input type="checkbox"/> High height to depth ratio of built space |
| P13 | MYSTERY | P1 P16 P21 |  | Light & shadow : Meandering pathways; Visual disconnect; curving edges | BUILDING LANDSCAPE | <input type="checkbox"/> Curving edges those slowly reveal <input type="checkbox"/> Dramatic shade & shadow <input type="checkbox"/> Overgrowing, less maintained landscapes obscuring view of the passer by. |
| P14 | RISK/ PERIL | P1 |  | Architectural cantilevers; Experiences perceived to defy gravity | BUILDING LANDSCAPE | <input type="checkbox"/> Building heights at least 5 times human height, cantilevered or supported by minor supports |
| P16 | CURIOSITY & EXCITEMENT | P1 |  | Vibrant colours; Views & vistas; Transitional spaces; Complementary contrasts ; Elevated planes; Hierarchally organized ratios & scales | BUILDING LANDSCAPE | <input type="checkbox"/> Landscape with a quality of prospect <input type="checkbox"/> Visual composition of open built such that open spaces revealed later than built <input type="checkbox"/> Curving progressing paths towards a space |
| P17 | CHANGE & METAMORPHOSIS | P1 |  | Seasonal varying landscapes ; Diurnal variability of solar patterns | BUILDING LANDSCAPE | Mix plantations of deciduous & evergreen trees |
| P18 | SECURITY & PROTECTION | P1 P12 |  | Spaces with weather & climate protection; Drop or lowered ceiling. | BUILDING LANDSCAPE | <input type="checkbox"/> Visual connectivity in a space through various levels <input type="checkbox"/> Shaded interactive spaces |
| P19 | ATTACHMENT | ----- | | Views & vistas ; information richness ; Central focal point | BUILDING LANDSCAPE | ----- |
| P20 | ATTRACTION & BEAUTY | P1 P11 P4 P6 |  | Landscapes; Complementary contrasts ; Spatial harmony | BUILDING LANDSCAPE | <input type="checkbox"/> Complementary colours of landscape and the surrounding built form <input type="checkbox"/> Caumaflauging of building into the landscape |
| P21 | EXPLORATION & DISCOVERY | P1 |  | Transitional spaces; Heightened planes ; Shade & shadow ; visual disconnect & perspective | LANDSCAPE | Creating visual perspectives with dark or low lit space at other end |



Figure Shaded interactive courtyard



Figure Façade screening through staggered sunshades



Figure Shaded courts





| P.NO | PATTERNS | INTER-RELATION | PICTORIAL REPRESENTATION | ATTRIBUTES PRESENT | DOMAIN OF APPLICABILITY | DESIGN CONSIDERATIONS |
|------|----------------------------------|------------------|---|--|-------------------------|---|
| P1 | VISUAL CONTACT | P2 |  | Vegetation; Animals; terrain; soil; moderately designed landscape | LANDSCAPE BUILDING | <input type="checkbox"/> Design to support visual connection that can be experienced for at least 5-20 minutes a day <input type="checkbox"/> Prioritizing real nature over simulated |
| P2 | NON VISUAL CONTACT | P3 P4 |  | Weather ; Natural Ventilation (operable windows) ; herbs & flowers | LANDSCAPE | Connections easily accessed from one or multiple locations Through building openings facing open spaces |
| P3 | NON- RHYTHMIC SENSORY STIMULI | ----- | | Cloud movement; Breezes | LANDSCAPE | ----- |
| P4 | THERMAL & AIRFLOW VARIABILITY | P1 P2 |  | Solar heat gain ; Shade & shadow ; Radiant surface material ; vegetation with seasonal densification | BUILDING LANDSCAPE | Orientation of built form to suitably shade the interiors as well as promote self-shading due to adjacent structures |
| P6 | DYNAMIC & DIFFUSE LIGHT | P1 |  | Daylight from multiple angles; Direct sunlight ; Diurnal & Seasonal light | BUILDING | Strategic usage of skylights and translucent materials like fibre- glass sheets, producing diffused lighting to interactive spaces |
| P7 | CONNECTIONS WITH NATURAL SYSTEMS | P1 P2 P6 |  | Simulated daylighting systems; Hedges & flowering vegetation | BUILDING LANDSCAPE | ----- |
| P10 | COMPLEXITY & ORDER | P1 P16 |  | Exposed structure ; Façade material; Floor plan ; Building skyline | BUILDING LANDSCAPE | Structure revealing fractal geometry |
| P11 | PROSPECT | P1 P12 P21 |  | Elevated planes Views including shade trees; Shade shadow | BUILDING LANDSCAPE | <input type="checkbox"/> Orienting building; openings, fenestrations optimizing visual access to indoor & outdoor vistas, open interactive spaces. <input type="checkbox"/> Where high ceilings present, building to be elevated 12" |

Figure 6 Case Study- Analysis

IV. SCOPE & RECCOMENDATIONS

Biophilia has a great potential to be explored in Architectural context. The framework proposed has evolved a systematic procedure for conversion to practical recommendations, but lacks the detailed analysis and application of the framework during a design process. It is crucial for the policy makers, planners and designers to adopt the proposal and modify it according to their respective domains, testing its applicability and generating a modified framework taking it a step closer to practical application.

Experiential approach is also a method to test Biophilic Hypothesis. But it requires a high level of case studies, related to different domains of Architectural spaces.

REFERENCE

- [1] Bloomer, K. (2008). The Problem of Viewing Nature Through Glass. In Kellert, S.F., J.H. eerwagen, & M.L. Mador (Eds.). Biophilic Design (253-262). Hoboken, NJ: John Wiley & Sons.
- [2] Browning, W.D., Ryan, C.O., Clancy, J.O. (2014). 14 Patterns of Biophilic Design. New York: Terrapin Bright Green, LLC.
- [3] Kellert, S.F. & B. Finnegan (2011). Biophilic Design: the Architecture of Life (Film). Bullfrog Films.
- [4] Stephen robert Kellert, Dimensions, elements, and attributes of biophilic design, Yale University, Retrieved on: 12 August 2016