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## Investigative Study of Relationship between Built Environment and Perceived Restorativeness: Cases of Colonial Churches of Dalhousie

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**Article history:** Submitted March 12, 2020. Accepted May 04, 2020. **Published online:** May 07, 2020

**Citation:** Rai, S., Asim, F., Shree V. (2020). Investigative Study of Relationship between Built Environment and Perceived Restorativeness: Cases of Colonial Churches of Dalhousie. *Visions for Sustainability*, 13: 31-43. DOI: <http://dx.doi.org/10.13135/2384-8677/4470>

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**Competing Interests:** The authors have declared that no competing interests exist.

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### Abstract

The built environment of a region can influence or dominate its ecosystems, services and can regulate the processes associated with human health and well-being. Built environments can be of any shape and size depending upon where they originate from and how they progress. They may be urban or rural, and this simple classification merely cannot explain the associated perception and satisfaction of the human population unless the Built environment is quantified in terms of its processes, resources and constituting elements in order to identify the major contributors, thus a larger scope of Built Environment comes into the frame. Urban areas are considered central business hubs and are hence created with elements of attraction and benefits which can influence human satisfaction; whereas rural areas are rich in nature and are claimed to be associated with psychological restoration due to their natural diversity. Studies in this aspect have covered either built environment or psychological health, there is still space for a multidisciplinary study which can explore the relationship between the built environments and how humans respond to it in a psychological manner. The relationship between these two is observed through a detailed study of two Churches of Dalhousie town in Chamba District, H.P. The study focuses on the four related aspects of Perceived Restorativeness Scale which can be influenced by the constituting elements of Built Environment. It also explores some of the human preferences in nature-rich religious built environments.

**Key words.** Biophilic Design, Biophilic Environment Variables (BEVs), Built Environment, Perceived Restorativeness.

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## **Introduction**

The term 'built environment' is fairly new. The built environment generally refers to: “manmade surroundings that provide the setting for human activity, ranging from the large-scale civic surroundings to the personal places” (Hollnagel, 2014). It corresponds to the need for a wide variety of disciplines and frameworks to find a common structure for interaction and growth that is concerned with this concept. During an age where environmental costs and long-term effects are of increasing concern, and where urbanization is affecting large areas of the Earth, the diverse notion of built environment becomes easier to express a wider perspective of ' systems, ' where there are complex interactions between a greater number of built components. The robust models originally developed for smaller buildings can be applied to entire cities, and trade-offs can be examined, for example, between the requirements of building design and infrastructure, or urban form and resource effectiveness.

Essentially, it is only possible to define the built environment as contrasted to the 'unbuilt' environment or the ecosphere. Ecosphere is often used as a descriptive term for the biosphere and as a term for zones in the universe where life as we know it should be sustainable (Huggett, 1999). The built environment as well as the ecosphere can be regarded as complex, dynamic self-producing systems in a system representation. As such, there is no relationship outside of history between the built environment and the ecosystem. On the contrary, it is constantly changing, representing and shaping the evolution of social systems in turn. Therefore, describing the built environment not as an object but as a social-ecological system is more reasonable. The paper will seek to analyse the background complexities of this human social-ecological system in further detail. It is expected that it will be possible to move towards an active theoretical basis for understanding the built environment by relying on a wider framework perspective.

## **Psychological Background of the Built Environment**

Research from fields such as neuroscience, biology, psychology, environmental policy, medicine, nutrition, fitness and leisure, and exercise science has shown that physical activity in nature can have beneficial effects on human wellbeing beyond physical responses. Maller et al. (2008) argued in a study of the health benefits of nature exposure: ‘That the natural environment is a key determinant of health is unquestionable’. Increases in physical activity levels can gain various health factors and help combat diseases in the lifestyle, but the positive psychological benefits of exercise in natural environments alone cannot be explained by increased levels of physical activity. Such theories pose important concerns about the existence of psychological health benefits that may arise from natural physical activity (Brymer & Davids, 2013; Sharma-Brymer et al., 2015). Considering this growing awareness, several attempts have been made to provide a rigorous theoretical basis for understanding how physical activity in nature enhances psychological health and well-being. The interaction between physical activity and nature encounters was explored from different perspectives, including ecopsychology (Brymer et al., 2010), outdoor education and leisure, wildlife and adventure encounters, green exercise (Herzog & Strevey, 2008), medicine, public health (Beute et al., 2014) and horticulture (Wilson, 1984).

Studies have identified psychological benefits resulting from (i) observing nature, (ii) engaging in nature (Kaplan & Talbot, 1983) and green spaces in urban environments (Tzoulasa et al., 2007), (iii) effects of brief encounters and extended periods in nature (Hull, 1992). (iv) real nature viewing in contrast with simulated nature settings (Mayer et al., 2009). Psychological benefits identified include stress relief (Ulrich et al., 1991) and restorative activity (Wolsko & Hoyt, 2012), improvements in positive mood states (Maller et al., 2006), life skills improvement (O’Brien, L. et al., 2011; Mayer & Frantz, 2004), reduces mental fatigue and concentration (Maller et al., 2008) and to minimize violence (Kuo & Sullivan, 2001). Psychological and emotional advantages were also correlated with adventure activities

performed in green environments (e.g., Brymer & Oades, 2009; Brymer & Schweitzer, 2013). Several interventions have been developed to provide opportunities for psychological health awareness and enhancement, interpersonal development, self-esteem, self-efficacy, and self-confidence (Hattie et al., 1997). For example, Doucette and colleagues (2007) explored a wilderness camp where for a week students were immersed in nature to encourage an experiential exposure to nature instead of learning about nature in a classroom. Researchers concluded that students have benefited from an enhanced ability to deal with anxiety, improved self-confidence, increased self-reliance and a greater understanding of social cooperation benefits.

### **Restorative Quality of Environment**

Fromm in 1973 introduced the term 'biophilia' as "the passionate love of life and of all that is alive" (Eckardt, 1992, p.233). Later Wilson in his book 'Biophilia' developed and defined it as "the innate tendency to affiliate with other forms of life" (Wilson, 1984, p.85). After Wilson presented his hypothesis the research on the restorative environment there developed two unique theories, Attention Restoration Theory [ART] by Kaplan and Kaplan in 1989 and Stress Reduction Theory [SRT] by Ulrich in 1991. Attention Restoration Theory [ART] highlights the efficiency of the natural environment that captures the attention in an easy way, enabling the mind to recover from a tired responsive system. Stress Reduction Theory [SRT] states how psychological stress and negative emotions can be eliminated by the natural environment like greenery and landscape. 'Restoration' is improvement of cerebral functions and mental stress through exposure to nature. Restorative environment is positive nature rich environment such as scenic views, natural water bodies, flora and fauna that enhances the restoration of human (Asim & Shree, 2019).

### **Perceived Restorativeness**

Perceived Restorativeness Scale [PRS], a tool by Harting et al. (1997) to measure the restorative quality of the environment through evaluating the richness of the four restorative factors – being away, fascination, extent and compatibility. Being away: the experience of being away from the cause of mental exhaustion. Fascination: a simplistic process of taking involuntary attention. Extent: to have the ability to interact with the environment without being bored. Compatibility: the phase of certain comfort and understanding where the user intellects unnecessary to use the intelligent or reasoning effort in order to understand the environment (Rai et al, 2019). The PRS is a psychometric scale used by environmental psychologists to evaluate the subjective perception of the regenerative power of an environment. An instrument used by architects is, for example, the BQI, which uses the principles of the ART for an objective evaluation (Berto & Barbiero, 2017).

### *Biophilic Environment Variables (BEVs)*

Biophilic Design is based on the original theories put forward in 'Biophilia' by American biologist E.O. Wilson, 1984. The term 'Biophilia' has ancient Greek origins (bios: life and philia: love) and Wilson called it 'the urge to join other life forms' (Kellert & Wilson, 1995, p.416). The concept of biophilia has been a part of human life for hundreds of thousands of years and it became a separate discipline of design after Kellert synthesized Wilson's original idea of Biophilia into design for the development of Biophilic design (Kellert et al, 2008). Frumkin (2001) categorized all aspects under the domains of Biophilia as Animals, Plants, Landscapes, and Wilderness.

Common Features of Biophilic Design (Kellert, 2008)	14 Patterns (Ryan et al., 2014)	
1. Natural lighting 2. Natural Ventilation 3. Natural Materials 4. Natural and Indigenous Vegetation 5. Ecological Landscape Design 6. Open Space 7. Water views and Vistas of Nature 8. Shapes and forms that mimic organic forms 9. Vistas characterized by refuge and prospect 10. Natural features that evoke mystery 11. Exploration and Enticement 12. Natural features characterized by order and complexity 13. Natural Rhythms 14. Natural processes and change 15. Aesthetic and recreational values of nature 16. Informational and intellectual values of nature 17. Emotional and Spiritual values of nature	Nature in the Space	1. Visual Connection with Nature 2. Non-Visual Connection with Nature 3. Non – Rhythmic Sensory Stimuli 4. Thermal and Airflow Variability 5. Presence of Water 6. Dynamic and Diffuse Light 7. Connection with Natural Systems
	Natural Analogues	8. Biomorphic forms and patterns 9. Material connection with Nature 10. Complexity and Order
	Nature of the Space	11. Prospect 12. Refuge 13. Mystery 14. Risk / Peril

**Table 2.** Biophilic Environment Variables (BEVs)

The concept of *biophilic design* reiterates the ecological understanding that all environments must possess the duo of biotic and abiotic elements in itself for improved psychological state of humans as well as for the appreciation of the natural realm of the environment (Downton, 2017). The most acknowledged versions of this are shown in Table 1, as introduced by Kellert & Wilson (1995) and later simplified under ‘14 patterns of Biophilic Design’ by Ryan et al. (2014). These subcategories are detailed and identified as 64 separate distinguished variables called Biophilic Environment Variables [BEVs] (Asim & Shree, 2019).

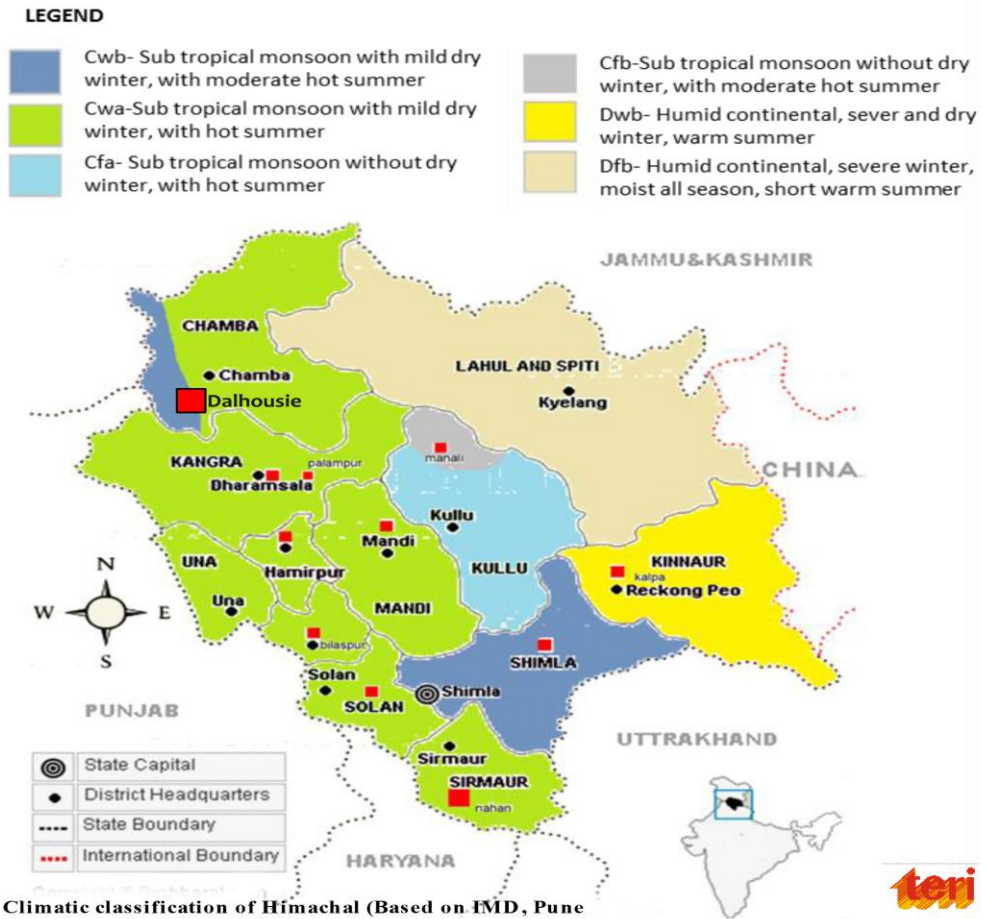
## Method

### *Aim*

To examine how the human psychological responses and preferences towards built environment ecosystems are altered by changing the constituting elements (Biophilic Environment Variables).

### *Location and Built Environment*

Two colonial churches of Dalhousie which is a small Himalayan town in the Chamba district of Himachal Pradesh, were selected to conduct the study; St. John’s Protestant Church built in 1863 and St. Francis Catholic Church built in 1894.



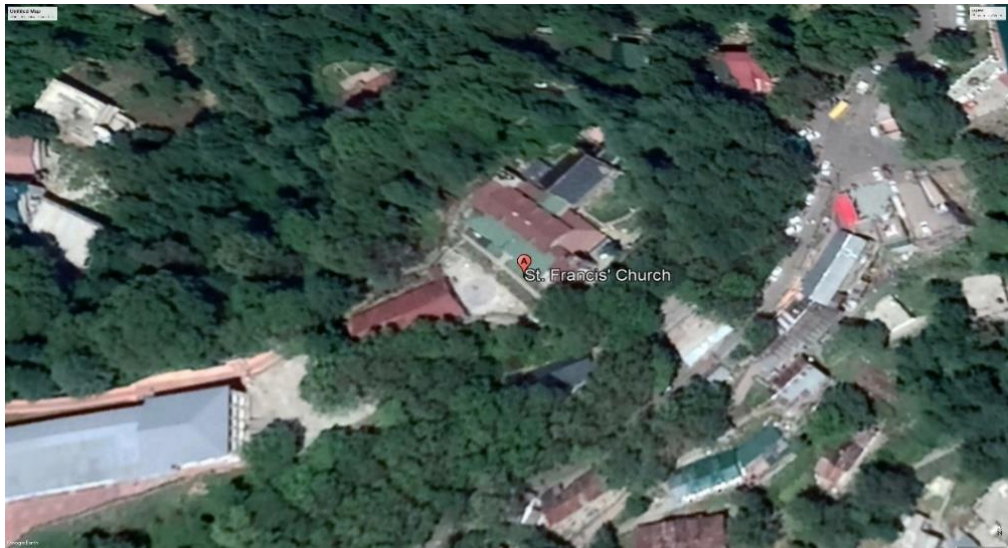
**Figure 1.** Climatic Classification of Himachal Pradesh with Dalhousie highlighted in Red (Source: TERI)

The town is situated on the ridge line of one of the hills of Pir Panjal range at an average elevation of 1970 meters from mean sea level with picturesque views of Chamba Valley and experiences moderate summer and freezing winters. The churches are the main tourist attraction in Dalhousie town and the architecture of the churches invites recognition for the town from all over the world over art, architecture and photography. They were built during the reign of British Imperialism in India under the European influenced style of architecture. St. John’s Church stands at the Gandhi chowk with a library next to it, adjacent to it resides the local market and a segment of Tibetan market, a few hotels and a tiny sprawl of eateries and restaurants.

St. Francis’ Church is on the uphill of Subhash chowk with few local food stalls and tourist infrastructure near the entrance. Both the churches are surrounded by abundance in diversity of flora on at least three sides and thus supports local fauna. The churches are at 1.4 kms apart from each other via ‘Thandi Sadak’, a road which acts as the logistical spine of the hilly town. The churches remain open to visitors from morning to evening; processions and church services are conducted on every Sunday.



**Figure 2.** Location of St. John's Church at Gandhi Chowk, Dalhousie.

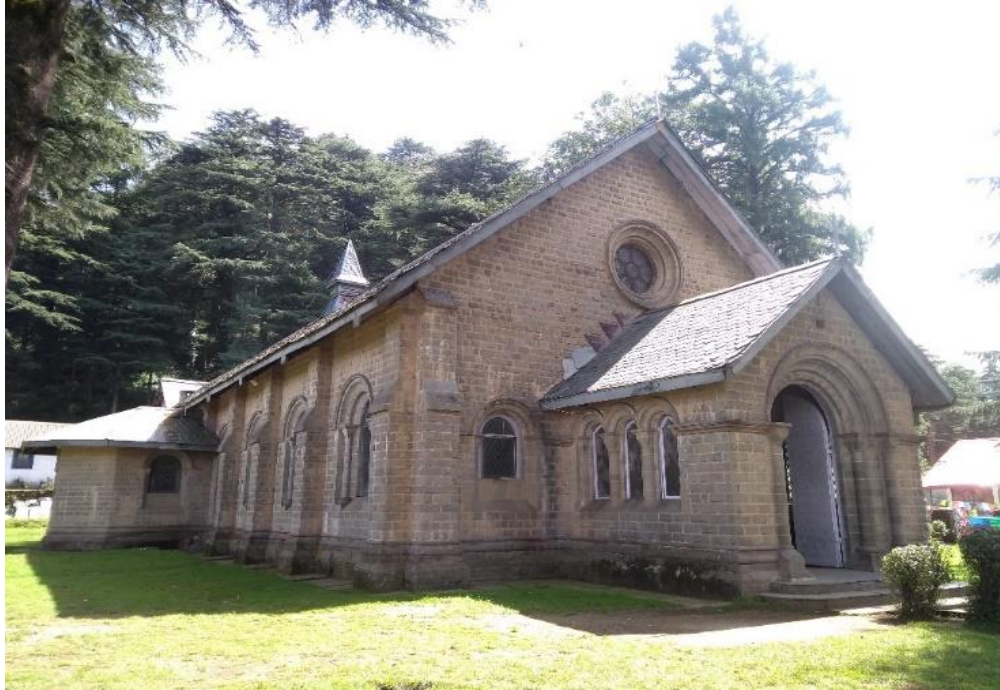


**Figure 3.** Location of St. Francis' Church at Subhash Chowk, Dalhousie. Brief Profile of Churches: Regional, Historical & Architectural Influence

### **St. John Church**

Built in 1863, it was the first church in Dalhousie built by the protestant missionaries. Initially, it was a wooden structure until the arrival of John H. Pratt who gave the idea of turning it into a permanent stone structure, hence, it was named after him. The church is erected on a simple rectangular plan with separate entrance for the priest. The choice of materials for this church has been mostly locally available ones including slate stone and timber sourced from local Cedrus Deodara. Walls of the church are dressed in ashlar stone masonry and the timber is employed in doors, windows, flooring and roof structure as well as in door and window frames. The unique feature of the finishing of its roof structure is that it is covered with hexagonal shaped slate stone pieces which is an unconventional method in this region, it rests on the purlins and rafters of local wood. The piers support the scissor truss on which the heavy mass slate mounted pitched roof is rested. Belgian stained glass which was heavily imported to India in the nineteenth century is used in semi-circular arch windows and centre-mounted

rose window above the entrance. There are a total of eighteen windows punctured into the stone walls of the church for light and ventilation, with three doors – the largest of them acting as main entrance door in front of the nave, second one on the right-side beside the nave entrance, and the third one is dedicated exclusively to the priest on rear left of the church compound.



**Figure 4.** St. John Church, Dalhousie.

#### **St. Francis Church**

The church was built through the contribution of the civilians and the residing British officers of the town in year 1894. St. Francis Church is a catholic church maintained by the diocese of Jalandhar and it resides uphill on the Subhash Chowk. The church compound has murals depicting the story of Jesus' life, struggles and his preaching. It has a simple rectangular plan, with a side entrance due to the steep sloped retaining wall at the front. Most of the construction material used in the basic structure are same as that of St. John Church including ashlar stone masonry for walls, locally available timber for the roof truss, flooring, door & windows and their frames. Pitched roof is also covered with hexagonal dressed slates. Single lancet (gothic) arches have been used in door and windows and the windows are styled with Belgian stained glasses.



**Figure 5.** St. Francis Church, Dalhousie (Chamba Dist.)

### *Participants and Procedure*

200 visitors (100 from each church as convenient sample) were asked to provide their responses about the church and its built environment on a 7-point scale on the original version of Perceived Restorativeness Scale (PRS-26) developed by Hartig et al. (1997)<sup>11</sup>. The presence and intensity of Biophilic Environment Variables were also recorded on a questionnaire for both the churches separately to understand the significance of Nature in the Space, Natural Analogues and Human-Nature Relationship in perceived restorative quality of the built environment. The following methods of data analysis were used to address the research aim. Comparison of means for the two churches on the PRS-26 parameters and BEVs was done along with a bivariate correlation analysis between the BEVs and PRS-26 responses. A regression model was created to develop and establish a relationship between the BEVs' subcategories 'Nature in the Space, Natural Analogues and Human-Nature Relationship' and the perceived restorative quality of the built environment.

## **Results and Discussions**

### *Descriptive Statistics*

An equal participant sample of 100 each was taken from the two cases, out of all the responding participants 73% were male and 27% were female who belonged to the age group 20 - 62 years with mean age 36.2 years. The respondents differed in their perception of the restorative environment as shown through Mean and Standard Deviations in Table 2. In the PRS domain of St. Francis & St. John, 'Compatibility' and 'Extent' recorded the maximum (10.26 and 7.349) and minimum (-4.12 and 4.685) mean and standard deviation respectively.

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<sup>11</sup> The 7-point bipolar scale was validated under a pilot study conducted for the Masters thesis titled 'The Significance Of Built Environment In Psychological Restoration: Case Studies Of Technical Institutes Of Himachal Pradesh' submitted to NIT Hamirpur. The original and complete study was published in 'Asim, F., & Shree, V. (2019). The impact of Biophilic Built Environment on Psychological Restoration within student hostels. *Visions for Sustainability*, 12.

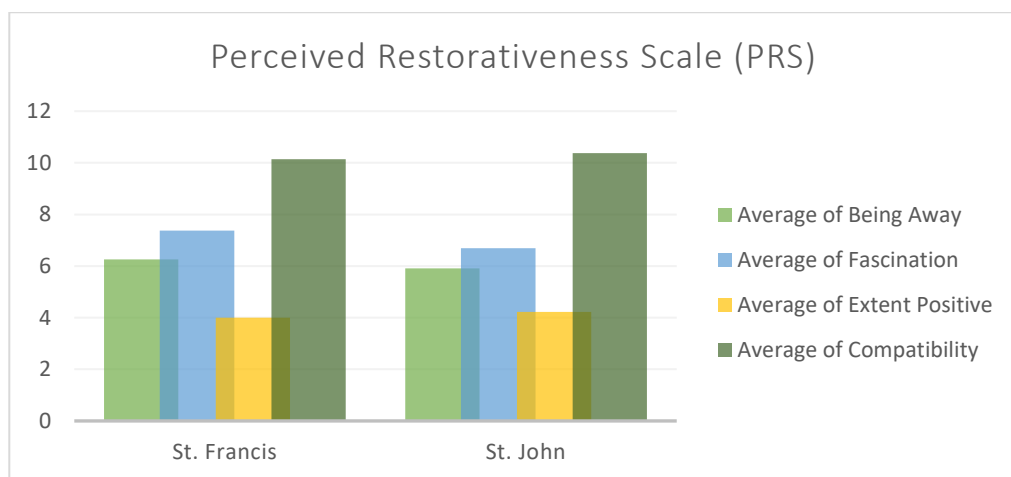


'Fascination' and 'Being Away' recorded the maximum (7.04 and 10.005) and minimum (6.09 and 5.787) mean and standard deviation. Standard deviation soared higher (10.005) for 'Fascination' and lower (4.685) for 'Extent'.

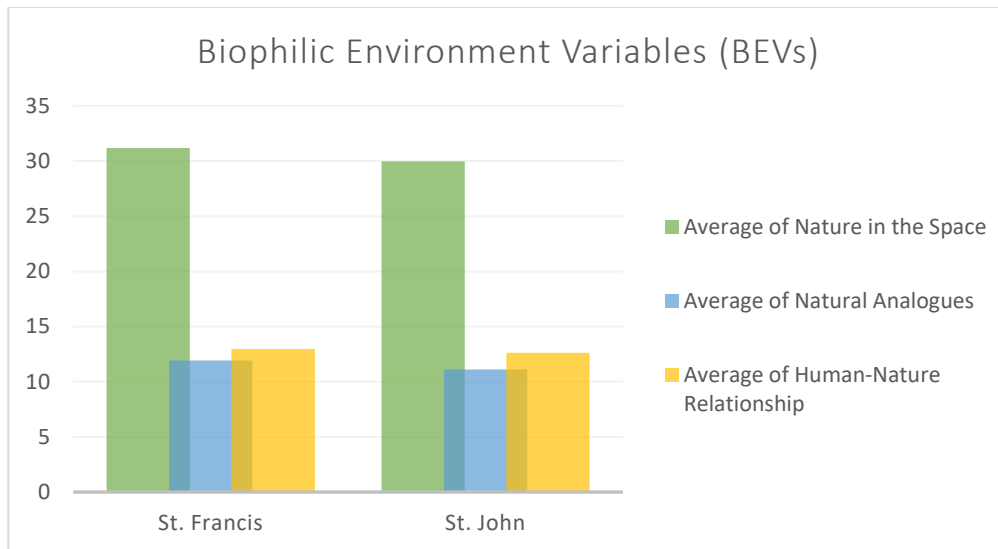
<b>Descriptive Statistics</b>					
	N	Minimum	Maximum	Mean	Std. Deviation
<i>Being Away</i>	200	-11	15	6.09	5.787
<i>Fascination</i>	200	-18	24	7.04	10.005
<i>Extent</i>	200	-12	9	-4.12	4.685
<i>Compatibility</i>	200	-7	27	10.26	7.349
<i>Nature in the Space</i>	200	6	50	30.59	13.134
<i>Natural Analogues</i>	200	1	21	11.53	6.838
<i>Human-Nature Relationship</i>	200	0	24	12.79	6.445
<i>Valid N (listwise)</i>	200				

**Table 3.** Mean and Standard Deviation of Perceived Restorativeness Scale and Biophilic Environment Variables

Figure 6 represents the comparison of means of Perceived Restorativeness Scale for both the churches. Means for all the Biophilic Environment Variables (BEVs): Nature in the space, Natural Analogues and Human Nature Relationship are shown in Figure 7.



**Figure 6.** Perceived Restorativeness Scale Results for the Churches.



**Figure 7.** Biophilic Environment Variables (BEVs) for the Churches.

#### *Bi-variate Correlation Analysis*

A bivariate correlation was run to understand the impact of major categorization of BEVs on the perceived restorativeness of the environment. Table 3 represents the results of the 2-tailed Pearson correlation. A strong and significant correlation was found between all variables of PRS with BEVs, except 'Extent' which showed no significant results out of the three correlations and the relationship could not be interpreted. The highest correlation (0.716 with  $p < 0.01$ ) was observed between 'Nature in the Space' and 'Being Away' followed by 'Natural Analogue' and 'Being Away' (0.716 with  $p < 0.01$ ). Out of the 12 different obtained correlations, 9 were found to be strong and significant.

		<i>Nature in the Space</i>	<i>Natural Analogues</i>	<i>Human-Nature Relationship</i>
<i>Being Away</i>	Pearson Correlation	<b>.716**</b>	<b>.716**</b>	<b>.595**</b>
	Sig. (2-tailed)	.000	.000	.000
	N	200	200	200
<i>Fascination</i>	Pearson Correlation	<b>.703**</b>	<b>.691**</b>	<b>.501**</b>
	Sig. (2-tailed)	.000	.000	.000
	N	200	200	200
<i>Extent</i>	Pearson Correlation	-.101	-.144*	-.112
	Sig. (2-tailed)	.155	.042	.114
	N	200	200	200
<i>Compatibility</i>	Pearson Correlation	<b>.519**</b>	<b>.567**</b>	<b>.683**</b>
	Sig. (2-tailed)	.000	.000	.000
	N	200	200	200

**Table 4.** Correlation Results for PRS and BEVs. \*\*. Correlation is significant at the 0.01 level (2-tailed). \*. Correlation is significant at the 0.05 level (2-tailed).

### Regression Analysis

A regression model was also prepared to testify and validate the correlation results considering the high impact of BEVs on the Perceived Restorativeness of the environment. BEVs were taken as the Independent Variables (IV) in the study whereas the PRS parameters were taken as Dependent Variables (DV). The results of the regression model are shown in Table 4 as standardized beta coefficient values along with their significant 'p' values and adjusted R square values. Independent Variable 'Nature in the Space' depicts a strong and significant relationship with 'Being Away' and 'Fascination', 'Natural Analogue' is entirely significant and strongly related to all four PRS parameters. 'Human Nature Relationship' is insignificant in 'Extent' and has a strong and significant relationship with the rest of the three PRS parameters.

<i>BEVs / PRS</i>	<i>Being Away</i>	<i>Fascination</i>	<i>Extent</i>	<i>Compatibility</i>
<i>Nature in the Space</i>	0.320***	0.390***	0.113	-0.035
<i>Natural Analogues</i>	0.299**	0.290**	-0.211	0.299*
<i>Human-Nature Relationship</i>	0.234***	0.105*	-0.053	0.279**
<i>Adjusted R square</i>	0.57	0.52	0.01	0.50***

**Table 5.** Linear Regression Model Results. Note: PRS = Perceived Restorativeness Scale. \*p<.05. \*\*p<.01. \*\*\*p<.001

The results of Comparison of Means, Bivariate Correlation and Linear Regression Model lead to the conclusion that the three major categorization of Biophilic Environment Variables (Nature in the Space, Natural Analogues and Human Nature Relationship) have significant impact on the perceived restorativeness quality of the environment. The PRS parameter 'Extent', however, fails to develop any significant relationship with the BEVs under the given environments.

Although both the churches were designed in the same architectural style and within the same era, they slightly vary in their perceived restorativeness quality due to richness and site context of their built environment's BEVs.

### Discussion

The BEVs are strong proponents of creating restorative environments but their impact is highly influenced by the emotional state of the visitors. The BEVs Visual connection with nature, Non-visual connection with nature, Material connection with nature and Prospect & Refuge have direct influence on the emotional stability of the visitors, their impact can be maximized through experimental design solutions and in turn it increases the ability of the visitors to perceive their environments as restorative. Most of the visitors in these churches are tourists and hence they represent a higher number of 'Fascination' which reduces as they spend more time inside the church compound. 'Being Away', 'Compatibility' and 'Extent' however still an active role play in perception of the environment as restorative. The usefulness of Being Away depends on the personal traits of the respondents and are highly random and inexplicable; certain randomized attributes like clouds, shadows and open spaces which further supports prospect-refuge theory can be set up to increase the restorative impact through broadly establishing this aspect of PRS. The use of stone and wood is found to be unconventional in comparison to the city lifestyle and it is one of the reasons why the church environment is considered a highly loaded with attributes of 'Fascination'. Rich detailing of wood and pinnacles add to the mystery of the design and invites interest and intrigue from the visitors.

### Conclusion

This study investigated the role of Biophilic Environment Variables (BEVs) in Perceived Restorativeness Quality of a built environment (Religious and historic in this case). It took

inferences from a different era and architectural style in order to standardize the responses to evaluate the data on the same bipolar scale. Future investigations can be conducted to explore the relevance of this study in preparing design guidelines for religious or tourism-oriented buildings which can serve the purpose of psychological restoration. Different built environments can also be studied using the same tool created in this study which uses BEVs and PRS-26 as their mode of data collection. The study promotes the use of natural features in architectural design to influence the human psychology in a constructive and balanced way. This is an attempt towards sustainable architecture which takes mental health of the user into account.

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