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Effect of spatial ambience on thermal adaptation in tropics: Case of free-running shared spaces in coastal hotels of Sri Lanka

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Abstract

Accommodation sector accounts for 21% of the global CO_2 emissions and the competitiveness of tourism industry in future is primarily depended on hotel energy efficiency which plays a vital role in eco-efficiency of tourist operations.

Tourists on pleasure travel prefer hotels which promote environmentally friendly built environment with free-running interiors. Thus the study investigates the design implications of free-running shared spaces and the influence of spatial ambience on thermal adaptation of tourists in tropical coastal hotels. Selected case studies are most popular semi-residential coastal hotels designed by the renowned architect Geoffrey Bawa and the methodology is consists of indoor thermal investigation, structured questionnaire and interview survey.

Thermal investigation informs a heat stress indoor thermal environments in the shared spaces. Comparison of the actual sensation with the predicted comfort votes explicitly highlights a discrepancy between the two. Thermally uncomfortable warm interiors are being predominantly perceived as neutral to cool thermal environments. Thus indicates the shared spaces demonstrate a stimulus for adaptive approach and informs to explore the factors influencing the psychological adaptation.

Actual experiences of the tourists relaxing in the pool lobby of Heritance (PLH) were evident for the optimum effect of thermal adaptation in comparison to other shared spaces. The attributes of spatial ambience has influenced the feeling of thermal pleasure and pleasantness. These spatial experiences generated through openness and integration of surrounding environment has promoted psychological adaptation of the tourists relaxing in this space to tolerate heat stress indoor microclimates of tropics. Thus the findings of this research determine significance of spatial ambience as a strategy for energy efficiency of tropical hotels.

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Keywords: coastal hotels; tropics; shared spaces; psychological adaptation; pleasantness

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1. Introduction

Tourism is one of the world's largest industries which support the economic growth of one third of the developing countries. Accommodation sector accounts for 21% of the global CO_2 emissions and the hotels rank among the top five types of buildings in the service sector for energy consumption. Nearly half of these emissions are shared by the hotels in the regions of North America (8%) and Asia pacific (6%) [1].With the current high growth emission trends in tourism, the sector may become a leading global source of greenhouse gas emissions in the future [2]. While climate change imposes greater threats on tourist destinations prioritization of sustainable tourism development is of prime importance. Thus the sustainable tourism policy recognizes to minimize the negative impacts of tourism on society and environment and maximize its positive contribution to conserve nature [3].

The "Agenda 21 for Tourism and Travel Industry" introduced by the World Travel and Tourism Council in cooperation with the World Tourism Organization informs the resource management and energy use as one of the prime issues of tourism [4]. Thus the competitiveness of tourism industry in future is primarily depended on hotel energy efficiency which plays a vital role in eco-efficiency of tourist operations.

Many studies conducted in the past decade discussed the energy use of hotels in terms of total energy use and Energy Utility Index (EUI). These studies were focused on hotels in few European countries, UK, New Zealand, Australia and countries in Asia such as Hong Kong, Singapore, Japan, Taiwan and Vietnam. Climate has an impact on EUI and higher values correspond to both the hot [5, 6] and cold [7, 8] weather. Moreover revealed electricity as the primary source of energy which accounts for 53% to 83% of the average total energy consumed [5, 6, 9, 10].

Air-conditioning dominates the hotel interiors and increases the annual energy consumption by 27% -77% depending on the type of the system [11]. Moreover, some studies were focused on energy use profiles in relation to building envelopes and energy saving scenarios is proposed for envelope thermal efficiency.

Resource efficiency as a major aim of the environmentally sustainable tourism illustrates two major concerns. One of the concerns is energy efficiency and application of renewable energy sources. Thus the existing literature sufficiently discussed the energy consumption and demand side energy management mechanisms for mechanical efficiency. However extremely limited research focus is noticeable on sustainable designs which promote resource efficiency by maximizing the use of natural light and ventilation in tourist facilities [3]. The sustainable development goal 12 on sustainable consumption and production of 2030 sustainable development agenda establishes sustainable tourism and sustainable building and construction as the sector focused task forces of this goal [12].

Thus the scope of this study is broadly focused on environmentally sustainable tourism interventions with a target towards resource efficiency through sustainable hotel designs. These designs integrate the natural setting of its immediate surrounding as an energy saving measure. Since there is an increasing trend to get attracted towards coastal tourism destinations in the tropics, less research interest is apparent on island countries. Thus, this research took place in Sri Lanka an island country on its way to become a major tourist destination of South Asia.

1.1 An overview of tourism in Sri Lanka

Tourist arrivals and accommodation in Sri Lanka increases by 25% every year and the Tourism Development Authority estimates an increase of 45,000 hotel rooms from the year 2011 to 2016 [13]. Hotel sector in Sri Lanka consumes 4-5% of the generated electricity of the country. Moreover the cost for electricity constitutes 18% of the total operational expenditure of a hotel, of which more than half is consumed for air-conditioning and 20% is for lighting [14]. With the current increasing trend in tourist arrivals, energy efficiency of tropical hotel buildings is one of the major challenges for the initiative on "greening" of tourism.

Coastal tourism on pleasure travel dominates the tourism and focuses on Southern coasts of the country. These tourists prefer hotels which promote environmentally friendly built environment with free-running interiors. However, except for very few hotels majority are unable to satisfy the aspiration of current tourist due to the widespread practice to patronize air-conditioned interiors for both private and shared spaces of a hotel.

Facility zoning of a hotel is composes of three distinct zones such as guest rooms, shared and service areas. Although there are limitations in promoting natural ventilation in private and service areas a greater potential is embedded in the design of shared spaces of tropical hotels. Thus the study investigates the design implications of free-running shared spaces and the influence of spatial ambience on thermal adaptation of tourists in tropics.

2. Adaptive opportunities for thermal comfort in naturally ventilated spaces

Bioclimatic design approach explores the nexus between climate and human comfort requirements [15]. The first step of this approach is to examine the climate and understanding of the negative impacts of climate on indoor thermal comfort. Köppen Geiger climate classification signifies about 60% of the geographical area of Sri Lanka represent the type 'Af' an equatorial fully humid climate. Fig. 1 shows the psychrometric chart created on Climate Consultant 5.5 software and reference comfort zones for Ratmalana/Colombo (6°82'N, 79°82'E and 5m above the mean sea level). This chart illustrates 8760 hourly data points of dry bulb temperature, relative humidity and comfort zones of fundamental and adaptive comfort models of ASHRAE standard 55 [16].

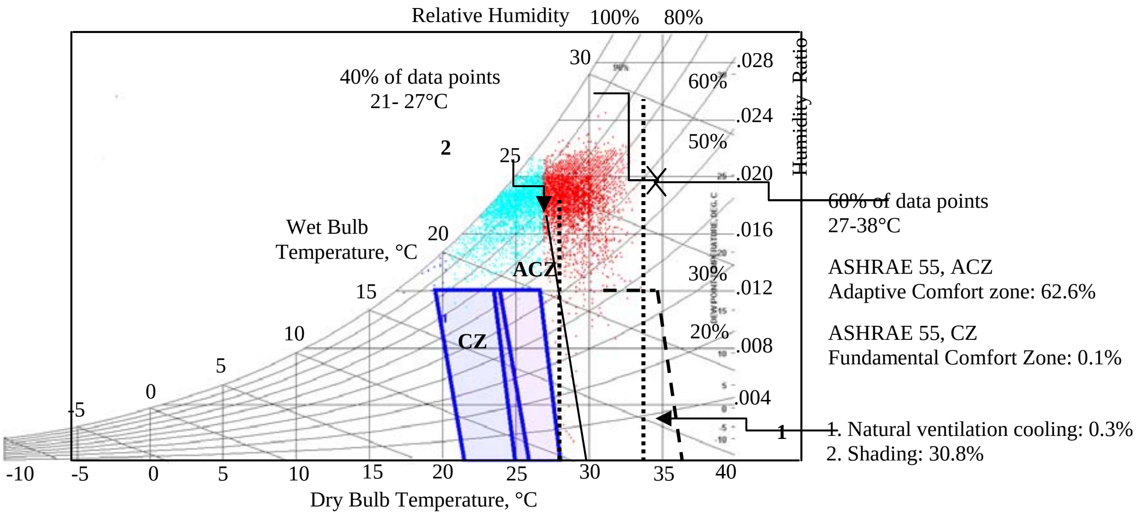


Fig.1. Psychrometric Chart for Ratmalana/Colombo (6°82'N, 79°82'E), Sri Lanka

Annual monthly mean, maximum temperature and relative humidity in Colombo, varies within the range of 26.2 to 28.8°C, 29.2 to 31.4°C and 78.3 to 83.6, 90.2 to 97.9 respectively. Moreover 60% and 40% of data points represents temperature in the range of 27-38°C and 21-27°C respectively. Climatic characteristics reveal predominantly an uncomfortable thermal status and further prove that, 99.9% of climatic data points are beyond the comfort zone (CZ) of fundamental model of ASHRAE 55 (refer Fig.1).

Shading and natural ventilation cooling have the potential to extend the comfort zone by 30.8% and 0.3% covering 2708hrs and 29hrs respectively. However the greatest influence on indoor thermal comfort is evident in adaptive actions of occupants and shown in the Adaptive Comfort Zone (ACZ). Natural ventilation cooling with behavioural adaptations to climate such as the use of climate matching clothing (0.5 Clo) and sedentary activities (1.0 Met) covers 62.6% of the data points and comfortable for 5485hrs of an year.

But, it is apparent that the adaptive passive cooling strategies are less beneficial for thermal comfort beyond air temperatures of 29.5°C and 50% of relative humidity. Thus informs a limitation in adaptive thermal comfort. Naturally ventilated spaces with adaptive adjustments alone are unable to overcome the uncomfortable status of overheated and over humid interiors common in tropical climates. Thus this study explores the influence of the spatial design exemplified in the degree of natural ambience as an adaptive strategy for extremely uncomfortable naturally ventilated indoor environments in equatorial fully humid climates.

3. Method of Study

This study is focused on naturally ventilated shared spaces in the coastal hotels designed by Geoffrey Bawa, the internationally renowned local architect. Selection of the case study hotel and justification for the period of investigation is based on the criteria as follows; (a) hotels located in the areas with the highest foreign guest nights,

(b) peak season for tourists on pleasure travel and (c) the most uncomfortable and extremely hot climatic period. The latest statistics of the Sri Lanka Tourism Development Authority informs the highest percentage of 35% of foreign guest nights was recorded in the Southern coastal hotels [13]. The months from January to March and December to February represents the hottest period and peak season for tourist travels respectively. Thus the studied hotels are Heritance, Light House and Citrus oriented towards the southwestern beaches in Galle district and the field investigations were performed in January 2016.

3.1 Case study hotels and the spatial ambience of the shared spaces

Fig. 2 shows the layout and spatial character of the selected shared spaces. All lobbies are evident for a similarity in orientation, which promotes the direct relationship with the ocean and the immediate natural microclimate of the coastal setting. However a distinctive variation is evident in the spatial ambience contained within the interiors.

As shown in Fig, 2A, the Pool Lobby of the Heritance (PLH) hotel is surrounded by a still water pond and the view towards the sea extends through an infinity pool. The spatial ambience promotes human scale and generates an impression of more naturalness towards it's indoors. Fig. 1B is the Transitional Lobby of the restaurant (TLLH) at Light House hotel. This lobby is placed at a higher level and promotes an unobstructed view of the ocean. The spatial ambience of this lobby gives a lesser impression on naturalness.

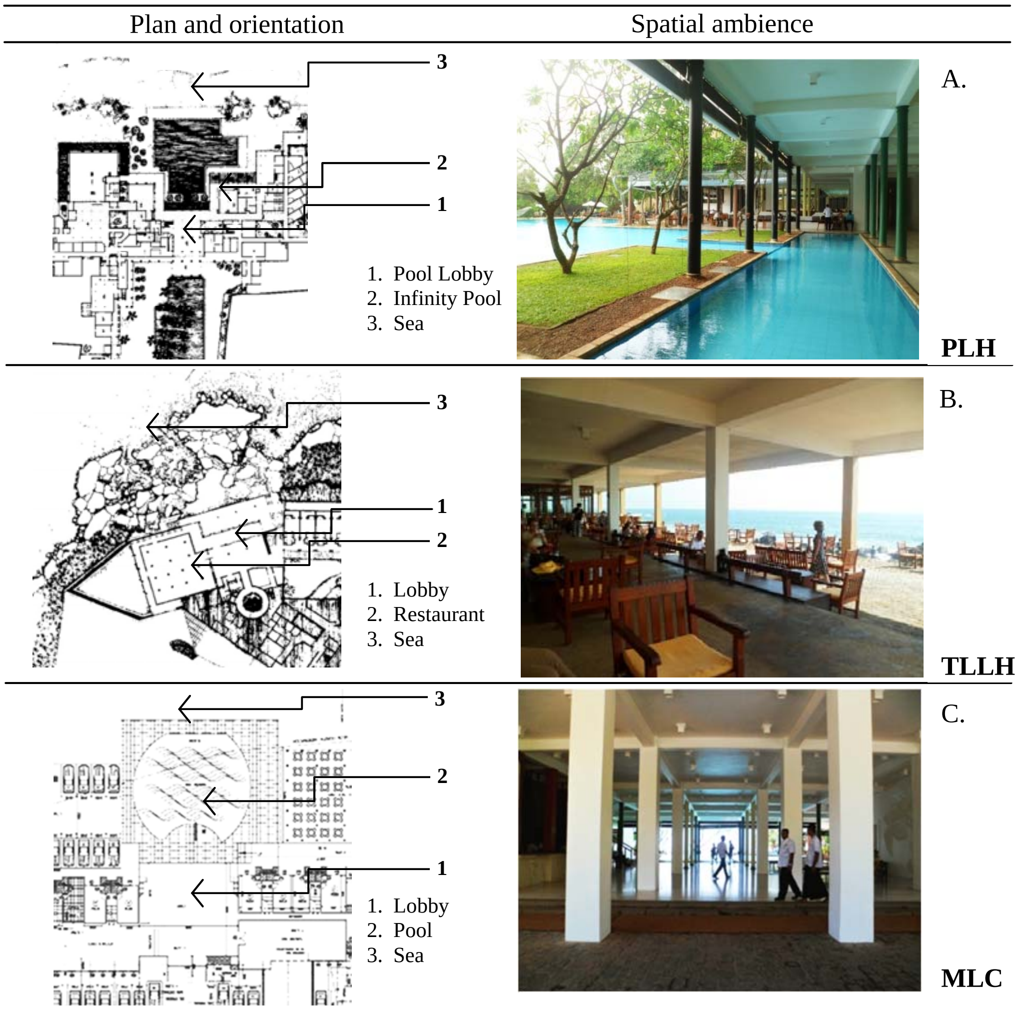


Fig.2. Spatial ambience of the monitored shared spaces (A) Pool lobby, Heritance: **PLH** (B) Transitional lobby of the restaurant, Light House: **TLLH** and (C) Main lobby, Citrus: **MLC**

Main Lobby of the Citrus (MLC) hotel shows an extremely different architectural ambience in comparison to other two lobbies of this study. This contemporary western character of its interior was introduced in recent renovations by another architect. This space is not related to human scale and lessens the degree of naturalness in it's indoors.

3.2 Onsite field investigations

The onsite field investigation of this study involved an indoor environmental monitoring and filling of a paper-based questionnaire on spatial ambience and thermal sensation. The free-running shared spaces for monitoring were identified in a walkthrough observation and an interview of the front desk staff of the case study hotels. Consequently the onsite monitoring was performed during three weekend days from 16^{th} to 24^{th} January 2016 in PLH, TLLH and MLC respectively. Based on the measured indoor environmental parameters and collected personal variables (1.0 met for seated quite and 0.5clo for typical summer interior clothing), the predicted mean vote (PMV) values were calculated using the online thermal comfort tool of the Center for the Built Environment [16]. All the data and questionnaire was analyzed using SPSS 18 with a significant level of 0.05. Questionnaires are composed in English and the respondents are tourists relaxing in the monitored shared spaces.

3.2.1. Measured indoor and outdoor microclimatic parameters and personal variables

Indoor and ambient microclimate was measured with calibrated and certified quick-response digital meters with sensors and data loggers. HOBO thermometers of model UX100-003 (08 units) and U23-001 (02 units), UX100-014M (04 units) with T thermocouples (16 points) and TSI Velocicalc 9565A (01 unit) were used to measure indoor air temperature (T_a)/relative humidity ($_{RHi}$), outdoor air temperature (T_o)/RH_o, internal wall temperature (T_w) and indoor air velocity (V) respectively. Location of the monitoring equipment was synchronized with the user propagation pattern in hotel lobbies and positioned at 1.1m height from the floor. Recording was started after 10 minutes of stabilizing duration and the data was recorded from 10-16hrs. This time period represents the daytime peak usage period of the hotel lobbies.

3.2.2. Paper-based questionnaire Investigation

The exploratory questionnaire of the survey is composed of four major sections, such as (a) personal identifiers, (b) personal preferences (c) spatial ambience and (d) subjective votes. Table 1 outlines, the subjective vote scales which include thermal sensation, thermal preference and thermal acceptability. Total number of 143 randomly selected respondents participated in the survey and the number of respondents participated in the survey of TLLH, MLC and PLH are 45, 48 and 50 tourists respectively. A summary of the questionnaire used in the survey is shown in Table 2.

Table 1. Subjective vote scales used in the survey

Scale value	Description of scales		
	tsv[a] scale	*tpv*[b] scale	*tav*[c] scale
3	Hot		
2	Warm	Much cooler	
1	Slightly warm	A bit cooler	Acceptable
0	Neutral	No change	Unacceptable
-1	Slightly cool	A bit warmer	
-2	Cool	Much warmer	
-3	Cold		

[a] Thermal Sensation vote
[b] Thermal Preference vote
[c] Thermal Acceptability vote

Table 2. A summary of the questionnaire used in survey

Personal identifiers
▪Age: 20or below, 21-40, 41-60, above 60; Gender ▪Region: Asia, Europe, Australia, Africa, N. America, S. America ▪Duration of stay in days: 1-3, 4-6, 7-10, More
Personal Preferences ▪Knowledge in Architecture, awareness of aesthetics ▪Impression of hotel and shared spaces, reasons for selection, influencing parameters
Spatial ambience ▪Inspirations on spatial quality, aesthetic and architectural character ▪Factors influencing on spatial ambience
Thermal sensation ▪Concerns on indoor thermal environment, wind movement ▪Thermal sensation, preference and acceptance scales

4. Results and Discussions

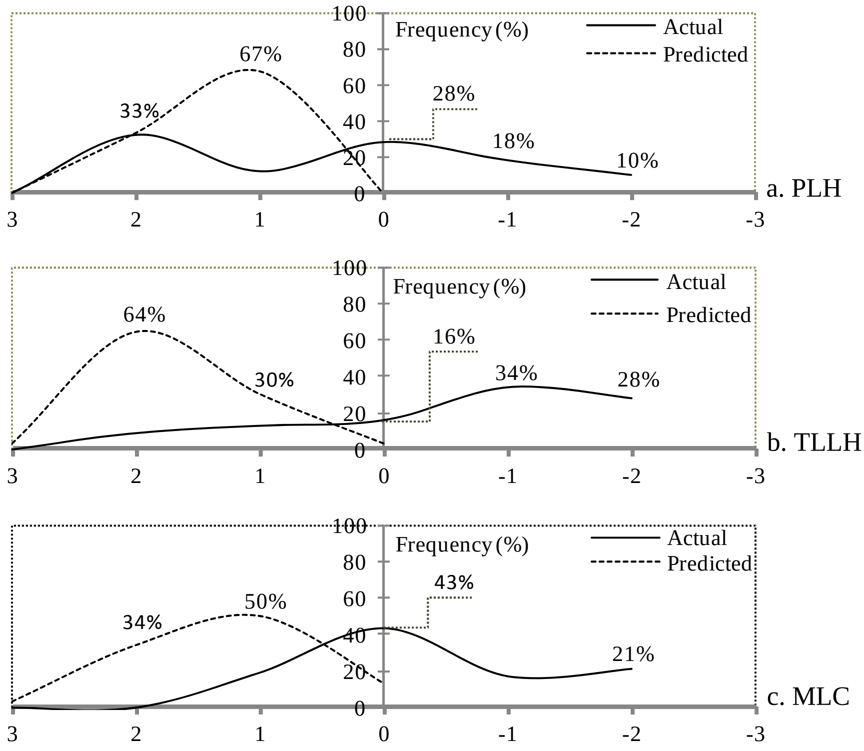
4.1 Physical microclimatic measurements: Indoor and Outdoor

Table 3 presents a statistical summary of the indoor environmental measurements of air temperature, relative humidity, wall surface temperature and air velocity for all shared spaces. Maximum and mean indoor air temperature and relative humidity of theses spaces ranges from 30.9°C to 32.7°C and 29.4°C to 31.1°C, 87% to 71% and 75% to 67% respectively. Air velocity of these interiors ranges from 0.02 to 1.62 m/s and the mean velocity varies in the range of 0.34 to 0.47. The shared space of PLH represents the highest mean air temperature while the lowest levels in MLC. Indoor SET (Standard Effective Temperatures) levels varies from 26.9°C to 35.9°C which correspond to slightly warm and warm human thermal responses with slightly uncomfortable indoor thermal environments in all shared spaces of the hotels.

Table: 3 Descriptive statistics of the indoor thermal environments of shared spaces

Variable	MLC				TLLH				PLH			
	Min.	Max.	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	Mean	SD
Indoor air temperature (°C)	27.8	30.9	29.4	0.78	28.2	32.7	30.8	1.2	29.6	32.1	31.1	0.7
Indoor relative humidity (%)	75.4	87.0	75.4	0.02	73.7	83.2	79.9	2.5	63.9	71.2	66.8	2.1
Indoor air velocity (m/s)	0.02	1.34	0.47	0.42	0.04	1.13	0.34	0.3	0.05	1.62	0.47	0.37
Indoor SET* (°C)	26.9	35.2	30.1	2.7	26.9	35.9	31.8	2.3	26.9	33.1	29.4	1.8

Min.: minimum, Max.: maximum, SD: standard deviation



Thermal sensation vote (*tsv*) scale for PMV index: -3 “cold”;-2 “cool”; -1 “slightly cool”; 0 “neutral”; 1 “slightly warm; 2 “warm”

Fig. 3. Comparisons of percentage frequency distribution for Predicted Mean Votes (PMV) and Actual Sensation Vote (ASV) (a) PLH (b) TLLH and (c) MLC

4.2 Nexus between the Predicted mean vote (PMV) and Actual sensation vote (ASV)

Predicted Mean Vote (PMV) for thermal environments in hotel lobbies were compared with the actual sensation vote (ASV) indicated in the exploratory paper based questionnaire survey.

Fig.3, A, B and C shows a comparison of percentage frequency distribution of these thermal sensation votes for monitored shared spaces of PLH, TLLH and MLC respectively. Percentage frequency distributions of PMV in all three shared spaces shows similar thermal environments with slightly warn to warm thermal sensations. PLH is evident for the worst thermal environment and closely followed by TLLH. Although thermal conditions for neutral sensation are not present in PLH, 13% and 3% of frequency distribution is apparent in MLC and TLLH respectively. Thus the predicted thermal sensations inform thermally uncomfortable indoor environments.

However the percentage frequency distribution of ASV with slightly cool to cool thermal sensations shows a distinctive difference with PMV. Furthermore neutral thermal sensation votes with a frequency distribution of 28%, 16% and 43% in PLH, TLLH and MLC respectively, highlight thermally amicable indoor environments.

Among all shared spaces PLH represents the hottest thermal environment with 44% ASVs counting 12% of slightly warm to 32% of warm responses of actual thermal sensation. Comparison of the actual sensation with the predicted comfort votes explicitly highlights a discrepancy between the two. Thermally uncomfortable warm interiors are being predominantly perceived as neutral to cool thermal environments with a frequency distribution of 56%, 78% and 81% in PLH, TLLH and MLC respectively. Thus indicates the shared spaces demonstrate a stimulus for adaptive approach and thus informs to explore the factors influencing the psychological adaptation.

4.3 Influential factors on psychological adaptation

Thermal comfort theory suggests the psychological adaptation significantly influences people's perception of space and their evaluations on thermal environment. Psychological adaptation is immeasurable, but the most influential factors for psychological adaptation are experiences, expectations, perceived controls and naturalness. The expectation of 'what the environment should be like' greatly influences people's thermal perception of a space [18]. Thus the questionnaire investigated the expectations of tourist's on spatial ambience and natural ventilation prior to their travel and their experiences of spatial attributes while relaxing in the shared spaces.

Table 4. Influential factors for psychological adaptation and measures on thermal perception

Expectations: Prior to travel	Personal experiences: During the stay	Measures on thermal adaptation
Consider spatial ambience	Likeability of spatial ambience (Pleasantness of the space)	Thermal sensation
Prefer natural ventilation	Naturalness of interior space	Thermal acceptability
	Feeling of Thermal pleasure	Thermal preferences
		Sensation on wind

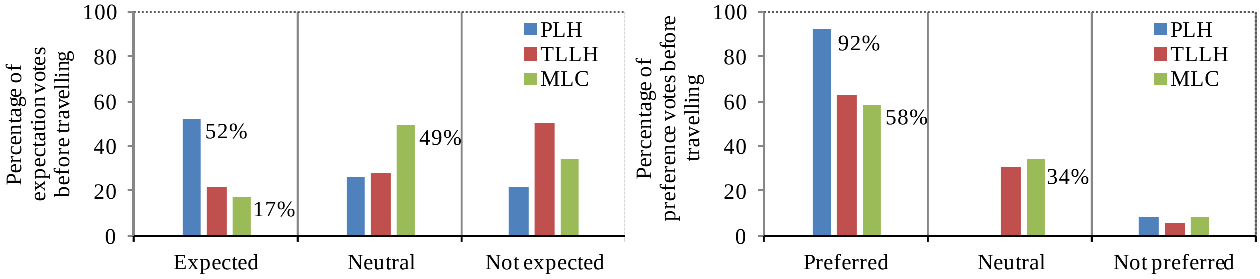


Fig. 4. Percentage preference votes on expectation votes of shared spaces before travelling (A) spatial ambience (B) prefer natural ventilation

4.3.1. Expectations – Prior to travel

Expectations of tourists prior to their travel were investigated and the corresponding questions are, ‘did you expect spatial ambience’ and ‘do you preferred natural ventilation’.

Fig.4. shows the percentage preference votes of tourists on expectations of shared spaces before travelling. Moreover the relationship of expectations and experiences on thermal preferences were statistically analyzed to evaluate their impact on thermal adaptation. Table 4 presents the intent of questions considered for expectations, experiences and measures on thermal adaptation. As shown in Fig.4A the highest vote of 52% on spatial ambience is expected by the tourists relaxing in PLH and less votes of 22% and 17% is evident for TLLH and MLC respectively. Similar trend is apparent for natural ventilation in PLH with 92% of preference votes. In comparison to PLH the tourists in TLLH and MLC has a lesser preference on natural ventilation. Thus the results inform expectations prior to the travel are prominent among the tourist’s relaxing in the shared spaces of PLH than the shared spaces of other two hotels. Pearson’s Chi-square test was used as a goodness-of-fit test to determine statistical significance between prior expectations and measures on thermal adaptation.

4.3.1.1. Effect of expectations on thermal adaptation

Expectations greatly influence people’s thermal perception of a space and help them to improve the fit between environment and their requirements [17, 18, 19]. Thus the psychological adaptation helps to promote satisfaction with the thermal environment [20]. Table 5 summarizes the associations between the expectations and thermal adaptation measures for all three shared spaces.

Table 5. Relationship between expectation prior to visit and thermal comfort scales

	P-value					
	Expect spatial ambience			Prefer natural ventilation		
Thermal comfort scales	PLH	TLLH	MLC	PLH	TLLH	MLC
Thermal sensation (TS) - PMV scale	0.23	0.16	<u>0.009</u>	0.67	0.13	0.55
Thermal preference (TP)	0.49	0.31	0.099	0.48	<u>0.03</u>	0.51
Thermal acceptability (TA	<u>0.008</u>	0.33	0.41	<u>0.015</u>	0.94	0.95

The results show a difference in the relationship of expectations and thermal comfort measures in shared spaces. PLH is evident for the strong relationship between both expectations and thermal acceptability with *p*-values of 0.008 and 0.015 ($p<0.05$) for spatial ambience and preference on natural ventilation respectively. However in MLC and TLLH the significant association is apparent only for a single expectation. Associations between spatial ambience and thermal sensation ($p=-0.009$), thermal preference and natural ventilation ($p=0.03$) is significant in MLC and TLLH respectively. Moreover informs the simplest thermal comfort scale of thermal acceptability is beneficial in the assessment of psychological adaptation in naturally ventilated spaces in tropics. Thus the results prove the strongest relationship of expectations and thermal acceptability in naturally ventilated shared space of PLH has promoted the psychological adaptation of tourists relaxing in this space.

Expectations are directly affecting experiences. People who stay in a space with a reason to be there are aware that it’s their own choice to stay in this place and make them more tolerant to the thermal environment [21]. Thus the following sections of this paper will explore the influence of experiences of an actual space on thermal adaptation.

4.3.2. *Effect of experiences on thermal adaptation*

Indoor spaces with a direct link and association with the natural environment creates a natural spatial ambience. These spaces contain an indoor environment for diversity and adaptive opportunity. Thus the spatial ambience of the indoor environments free from artificiality influences it’s users to tolerate wide changes of physical environment

[22]. The intent of the questions of this study is focused on naturalness of the space, likability of spatial ambience-the pleasantness of space and the feeling of thermal pleasure (refer Table 4). These questions were answered in a scale of 6 ranging from absolutely yes to not at all. Moreover sensation of wind is considered as an additional measure on thermal adaptation. The sensation of wind was answered in 7 point scale ranging from -3 to 3 with just right at the center. Negative values represent stagnant to slightly still conditions and positive values are ranging from slightly windy to much too windy sensations of wind movement. Table 6 shows the results of the association between the experiences and the measures of thermal adaptation for all shared spaces.

Table 6. Relationship between actual experiences of indoor spatial environment and thermal comfort scales

Thermal comfort scales	p-value								
	Thermal Pleasure			Naturalness			Pleasantness		
	PLH	TLLH	MLC	PLH	TLLH	MLC	PLH	TLLH	MLC
Thermal sensation (TS) - PMV scale	0.10	0.40	0.32	0.4	0.06	0.24	0.61	0.17	0.1
Thermal preference (TP)	0.93	<u>0.03</u>	0.84	0.35	0.31	0.32	0.88	0.89	0.09
Thermal acceptability (TA)	<u>0.003</u>	0.28	0.24	0.14	0.42	0.9	<u>0.005</u>	0.84	0.47
Sensation of wind	0.06	0.26	0.29	<u>0.001</u>	0.25	0.72	0.58	0.185	0.24

As illustrated in Table 6, tourists experiences on thermal pleasure and pleasantness in PLH is evident for a significant relationship with thermal acceptability. However the actual experience of naturalness in PLH shows a significant relationship with the sensation of wind. Thus highlight the environmental stimuli of natural wind is associated with the natural spatial ambience of the shared space of PLH. Moreover tourist's experience on thermal pleasure in TLLH shows a significant relationship with thermal preference. There is no significant relationship between actual experiences of tourists and thermal adaptation in MLC.

Thus the results prove the effect of actual experiences of its users in the shared space of PLH has positive influence on thermal adaptation in comparison to other shared spaces. Thus the attributes of spatial ambience influenced on the feeling of thermal pleasure and pleasantness of space has a positive effect on psychological adaptation. These spatial experiences have supported the tourists relaxing in this space to tolerate thermally uncomfortable indoor environments with slightly warm to warm thermal sensations in tropical coastal hotels.

4.3.3. Nexus between expectations and experiences

This section explores the relationship of expectations and experiences in PLH which demonstrated the greatest effect of psychological adaptation. Table 7 shows the relationship and percentage preference votes between expectations and experiences in the naturally ventilated shared spaces. Significant relationship is evident between the prior expectation of spatial ambiences and actual experiences on thermal pleasure and pleasantness of indoor space. A prior expectation on relaxing in naturally ventilated space is associated with thermal pleasure.

Table 7. Relationship between expectations and experiences associated in the naturally ventilated shared space of PLH

Expectations – Prior to visit	Experiences – During the stay							
	Thermal Pleasure (%)				Pleasantness (%)			
	p	Yes	Neutral	No	*p*	Yes	Neutral	No
Spatial ambience	0.017	82	7.7	10.3	0.027	66.6	30.7	2.7
Relaxing with natural ventilation	0.002	82	16	2				

Thus the results explicitly prove the prior expectations of spatial attributes and natural ventilation of a shared space have a positive effect on real experiences on thermal pleasure, which influences the psychological adaptation to tolerate thermally uncomfortable interiors in coastal hotels. Furthermore the spatial ambience promoted through passive designs acts as a catalyst for resource efficiency in coastal tropical hotels.

Conclusion

This paper explores the impact of spatial ambience on thermal adaptation of tourists relaxing in free running shared spaces in tropical coastal hotels of Sri Lanka, designed by the renowned architect Geoffrey Bawa. These shared spaces represent a similar environmental milieu due to its orientation and interaction with the ocean but the design attributes of each space promote a difference in spatial ambience. Pool Lobby in Heritance (PLH), shows the most naturalness among the studied shared spaces and the least is evident in the Main Lobby of the Citrus (MLC).

Onsite thermal investigation revealed thermally uncomfortable warm indoor environments with air temperatures in the range of 30.9 to 32.7C and 71 to 75% of relative humidity during the daytime hours. However, the subjective vote of tourists relaxing in these shared spaces establishes that these warm interiors are being predominantly perceived as neutral to cool thermal environments.

These results demonstrate a stimulus for adaptive approach which has influenced the psychological adaptation through factors on perception of space. Thus the nexus between tourist's expectations prior to the travel and their actual experiences while relaxing in these shared spaces were assessed. Expectations prior to travel are prominent among the tourist's relaxing in the shared space of PLH than the shared spaces of TLLH and MLC.

Results prove the strongest relationship of expectations and thermal acceptability is evident in the free running shared space of PLH and its spatial ambience has promoted the psychological adaptation of tourists relaxing in this space. This spatial ambience has originated the feeling of thermal pleasure and pleasantness. These spatial experiences have supported the tourists relaxing in this space to tolerate thermally uncomfortable indoor environments of tropical coastal hotels. Thus the study explicitly establishes the significance of spatial ambience in eco-efficiency of tropical hotels which plays a vital role in the initiatives of sustainable tourism.

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