

Spatial Tranquility in Architecture

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Abstract:- Our surrounding environment has a deep impact on us. Humans are somewhere directly or indirectly affected by the space in which they spent a major part of their day and it eventually affect the quality of output delivered while being in that space.

This study revolves around analyzing such design strategies and ideologies that induce certain level of calmness and serenity through the man-made built environment with a major focus on how to eliminate the impact of undesirable noises and welcoming tranquil and serene features in the built environment to enhance the quality of space specifically a residential space. The study addresses this tranquility as a spatial phenomenon for a residential space, because today's fast pacing urban lifestyle and with high urban densities, turning it into a concrete jungle, demands need for rest and mental composedness and the human longing for contentedness, thus how the building in which the user spends his day can work towards enhancing the wellbeing, provide quality of life and productivity benefits is one of the vital roles of architects. A previously established set of equations, Tranquility Rating Prediction Tool (TRAPT) by Bradford University is utilized to further quantify the tranquility of a residential space and analyze the implication of the equation for an Indian residence and understand the factors that govern the tranquility.

Residential areas one of the major land use of an urban scape when planned towards tranquility approach, will somewhere make a contribution towards the urban tranquility where quality of life is enhanced. Since times people have come up with their own interpretation and a definition of architecture which shows how vast and limitless could be the scope of it. This study thus tries to attempt that challenging part of architecture where we suggest a perspective of notion of 'spatial tranquility' in a residential space where the varying levels of tranquility has an impact on user experience and the quality of life within a man- made built environment.

Keywords:- Tranquility, TRAPT, Spatial, Architecture.

I. INTRODUCTION

1.1 Aim

The aim is to identify various elements and aspects that could be integrated in the design process to work towards evolving tranquil and serene spaces in the context of an Indian residence.

1.2 Objectives

- 1.2.1 To analyze those architectural elements that fulfills the motive of a structure to offer tranquility.
- 1.2.2 To introduce tranquility as a spatial phenomenon in today's design process of an Indian residence.
- 1.2.3 To identify the implication of TRAPT (Tranquility Rating Prediction Tool) to validate/quantify the tranquility of a residential space.
- 1.2.4 To understand the factors that govern tranquility

1.3 Scope of Work

The study revolves around introducing and understanding the significance of tranquility as a spatial notion in the designing of residential units. The study helps in understanding how and why a space could have been better if such an approach is adopted in the initial design process. A perspective is set to suggest that a tranquil space is somewhat where the sound and visual components meet a peaceful balance and the natural factors have a major role to play in it. It is an attempt to increase the sensitivity towards the spatial experience while designing. In today's time where user performs work from the comfort of their homes, designing a quality space which affects the user's physical and psychological needs in a positive way becomes one of the roles of the architects. Designing residential units where a user can feel relaxed and contented amidst the hustle bustle of the busy and fast pacing urban lifestyle can contribute toward achieving urban tranquilitygoals.

1.4 Limitations

The research is limited to the study of tranquility in a private residential space. Also, the study does not touch upon the various acoustical treatments that may be effective in reducing noise levels and provide a quiet and tranquilenvironment.

II. TRANQUILITY

2.1 Choice of term

The term 'tranquility' is chosen as the closest conjecture to the ideology behind this work. The literal meaning of it stands for the state of being calm, peaceful and quiet. Tranquility can be used to both describe the surrounding environment and the personal experience or the state of an individual feeling. The term in its way reflects the relationship between the environmental conditions and the

emotional and mental state of a person which is indeed the ground of this work. Every place has an atmosphere connected with it, be it a crowded street, a garden, our home, open field or an enclosed reading room everything has its own quality of atmosphere which affects our personal feeling directly or indirectly. Therefore, place can generally be described as tranquil and serene depending on its environmental parameters and similarly the term can be used interchangeably to describe the emotional aura that surrounds a person. Both meanings are so seamlessly connected that introducing a quality as a 'spatial phenomenon' holds a strong relation in the field of architecture and this work tries to explore the same.

2.2 Relevance in an Indian Residence

“A house should be constructed of ‘sensation and memory’ and not merely a function as a ‘machine for living’”

“Designing for emotions, Designing for aesthetic Designing for interactions Designing for connections-but most of all, designing for experience” [1] - Nariman Sehata

The above stated intellectual words reflect how deep is the connection between the space and the impact it leaves on the user. As an architect, it's our responsibility to make a personal connection not just with the physical environment but how it triggers our memories and emotional responses.

For an individual, the home is a 'safe heaven', a comfort zone where we spend majority of our time, a space where we just try to be ourselves. Offering a quality of life in a residence is a vital aspect which is rooted to its 'spatial composition'. This is where the idea of spatial tranquility comes in to provide an enhanced mental well being and productivity benefits to the high urban density. Inducing certain level of calmness and serenity through the man-made built environment by eliminating undesirable noises and welcoming tranquil and serene features inside a residence such as light quality and sunlight, temperature, nature, waterbody, places to pause, materiality and thus the architectural detail and symbolism.

Introducing the idea of tranquility as a spatial phenomenon in an Indian residence today becomes vital as in the fast pacing urban lifestyle demands need for rest and mental composedness and the human longing for contentedness, thus how the building in which the user spends his day can work towards enhancing the wellbeing, provide quality of life and productivity benefits and a unique character to the 'architecture' of the building. In today's scenario where people are spending major time and performing various activities from their homes focusing on

providing a quiet, noise free and experiential quality to its space becomes a point to be touched upon. The varying levels of environmental noise, the impact of naturalness such as the plantations or may be the sound and the feel of flowing water, the sound of chirping birds etc. are some of the many features that have been worked upon since times to enhance the experiential qualities of a space. Thus, understanding the undesirable and the desirable sounds and various other elements that should be welcomed inside a space is the intention to introduce tranquility as a spatial phenomenon in this research.

III. CASE STUDIES

Below mentioned table 1 is a list of all possible features observed in the case studies of residential projects around India where architects have worked towards tranquility and this
 -LeCorbusier

[1] *The Journey to Tranquility- How architecture design can take you there, thesis work by Nariman Sehata* helped to understand which where the most common technique adopted among all to work towards the tranquility goal.

CASE STUDIES	CADENCE ARCHITECTS		DIPEN GADA and ASSOCIATES		DD ARCHITECTS	SPACEFICTION STUDIO	NEOGESIS	CHARGED VOIDS
	Bangalore house	Badari residence	Arham House	Nene's residence	A Tranquil Space	Soul Garden House	Junglowy	Twin Courtyard House
TRANQUIL FEATURES								
Internal courtyard	✓	✓		✓		✓	✓	✓
Gardens		✓		✓	✓	✓		✓
Green decks		✓		✓				✓
Daylight wells	✓		✓	✓	✓	✓	✓	✓
Natural ventilation	✓	✓	✓	✓	✓	✓	✓	✓
Water element		✓		✓	✓	✓		✓
Welcoming natural sounds		✓		✓	✓	✓		✓
Dramatic play of light and shadow	✓		✓	✓		✓	✓	✓
Play of mass and voids		✓				✓		✓
Facades treatment	✓	✓	✓	✓		✓		
Perforated screens	✓		✓	✓		✓		
Interesting openings	✓	✓	✓	✓		✓	✓	
Choice of material		✓		✓	✓		✓	✓
Choice of bold colours			✓		✓	✓		

It is thus observed that every project has tried to provide thermal comfort inside the residence through daylight and the 'wind tunnels' which makes it a soothing place to reside in. This along with providing thermal comfort through natural ways affects the mental state in a positive way. It can be inferred that the role of greenery that is, the presence of

gardens and internal courtyards plays a vital role to enhance the spatial quality and is highly adopted in the above case studies.

It is interesting to observe the introduction of the essence of nature in the form of play of light and shadow to elevate the experience of a space is highly adopted in designing the spaces around the residence. The soothing and relaxing nature of water is respected and is used in the interiors as well as the exterior of the various works interpreted here. The openings which welcome the outside greenery and daylight are interestingly planned with varying sizes and perforations to add interest and control and regulate the quality and the amount of light entering the space. The overall plantation of trees around the residence acts as a buffer to the outside noise thereby reducing the noise levels inside.

IV. TRANQUILITY RATING PREDICTION TOOL (TRAPT)

4.1 About TRAPT

The researchers at University of Bradford formulated an equation to measure the tranquility of a space in the urban areas, through a series of equations, known as the TRANQUILITY RATING PREDICTION TOOL (TRAPT).^[2] The Tranquility Rating Prediction Tool attempts to measure the tranquility of a place on a scale of 0 – 10 with, 0 being not at all tranquil to 10 being the most tranquil. The tool utilises two factors, the level of man-made noise and the percentage of contextual features in view which may include any landscape feature.

4.2 The Equation

With series of experiments at Bradford University the Tranquility Rating Prediction Tool was evolved which utilises the percentage of natural features contained within a frame and either of the noise indices LA_{max} or LA_{eq}, as the key components. The final model proposed could be used to determine environment existing tranquility rating and to calculate a tranquility rating value in response to some visual and acoustic parameters.

The Tranquility Rating Prediction Tool (TRAPT) utilizes the following set of equations:

$$TR = 13.93 - 0.165 LA_{max} + 0.024 NF \quad (1)$$

$$TR = 8.57 - 0.11 LA_{eq} + 0.036 NF \quad (2)$$

Where TR is the subjective Tranquility rating on a scale ranging from 0 (low) to 10 (high), LA_{max} is the maximum sound pressure level, LA_{eq} is the equivalent/avg sound pressure level (A-Weighted) and NF is the percentage of natural features (excluding sky) present within a picture

frame

4.3 The Methodology Adopted

A certain method is adopted to identify the validation of the application of TRAPT for Indian Residences and formulate the analysis of tranquility ratings for the external as well the interior spaces of an Indian residence and thus understand the various factors that govern tranquility. For this purpose, three different Residences were chosen around Indore, Madhya Pradesh which were bound to be exposed to varying levels of sound pressure (LA_{max} or LA_{eq}) which for the purpose of this work was calculated using a mobile application called decibel X meter which converts a smartphone into a professional sound meter. Yet however this proves to be the limitation of this work since a mobile application was used it is obvious to have minute errors in its accuracy while measuring the sound pressure levels.



Figure 1 Decibel X App for measuring sound levels (A weighted)

Further for determining the percentage of natural features, according to the research work at Bradford University, it is calculated by laying a 10 X 10 grid on three picture frames of a single space and then counting the numbers of grid occupied by natural features which includes all types of flora, greenery, water feature including stone walls, pebbles and other landscaping features. Within the overall calculations the amount of sky was not taken into considerations due to camera angle deviations. Hence, this gave the value of NF required.

[2] A R. J. Pheasant, G. R. Watts, K. V. Horoshenkov: Validation of a tranquility rating prediction tool

4.4 Analysis and Validations

Applying the equation to the various spaces of the residential projects around Indore, Madhya Pradesh lead to a observed trend as to how the tranquility was related to and changing according to the values of LA_{max} and LA_{eq} and the percentage of natural features. Similar to the experiments at Bradford University the same trend was observed which gives a notion that to an extent the TRAPT holds useful to quantify the tranquility of a residential space and understand the factors which regulates it.

Table 2 lists down all the calculated values of TR for the varying levels of sound pressure levels for the different spaces of the three selected residences.

TYPE OF SPACE	NF %	LAm _{ax} [db(A)]	TR	LA _{eq} [db(A)]	TR	Mean TR
Residence 1						
Front yard	86	45.2	8.53	38.1	7.47	8
Internal Courtyard	63	42.1	8.5	35.1	6.97	7.73
Drawing Living	35	45.1	7.33	32.1	6.3	6.81
Dining + Kitchen	20	50.2	6.12	36.4	5.3	5.7
Residence 2						
Front yard	57	58.2	5.7	45.6	5.6	5.65
Living + Dining	38	61.2	4.74	48.6	4.6	4.6
Drawing room	40	62.3	4.62	49.7	4.5	4.58
Bedroom	64.3	54.2	6.53	32.6	7.3	6.9
Backyard	76	57.1	6.33	44.1	6.45	6.4
Residence 3						
Drawing room	31	65.3	3.9	43.2	4.9	4.4
Dining+ Kitchen	53.6	61.7	5.03	42.8	5.79	5.4
Bedroom	56	57.1	5.85	34.6	6.7	6.3
Backyard	80.6	50.1	7.6	39.2	7.15	6.4

Table 2 calculated values of TR for different Values of Sound pressure Levels and NF% for the three residences

Further for a better analysis study the spaces were categorised into two different categories as the outdoor green spaces around the residence and then the internal spaces of the residence. For the analysis, the calculated TR values for both the categories are plotted against LAm_{ax}, LA_{eq} and NF to understand the trend and the role they play in the tranquility level.

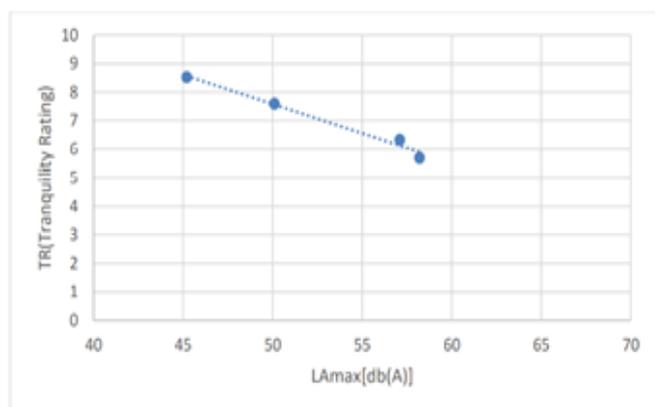


Figure 2. Calculated TR(Tranquility Rating) plotted against the LAm_{ax} values for the three residences(backyards and frontyards)

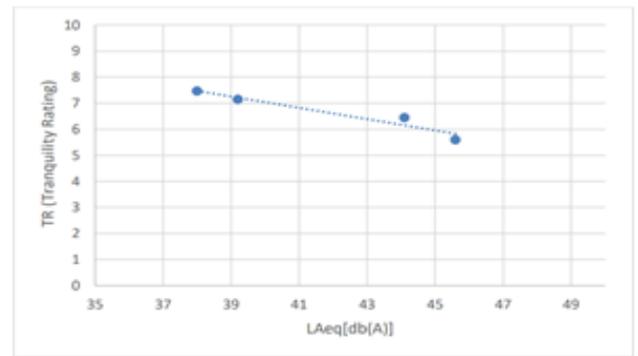


Figure 3. Calculated TR(Tranquility Rating) plotted against the LA_{eq} values for the three residences(backyards and frontyards)

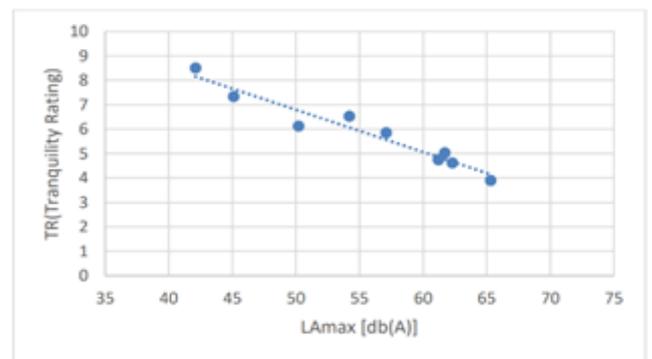


Figure 4. Calculated TR(Tranquility Rating) plotted against the LAm_{ax} values for the three residences(internal spaces)

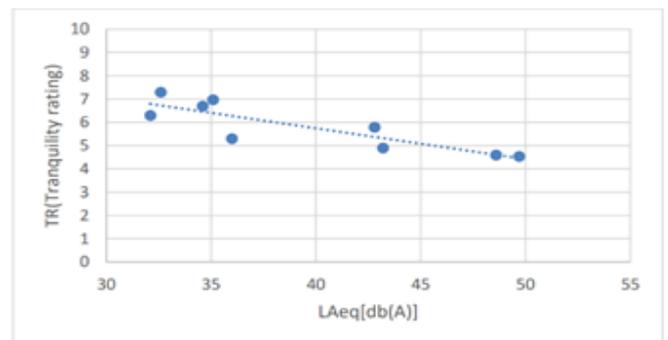


Figure 5. Calculated TR(Tranquility Rating) plotted against the LA_{eq} values for the three residences(internal spaces)

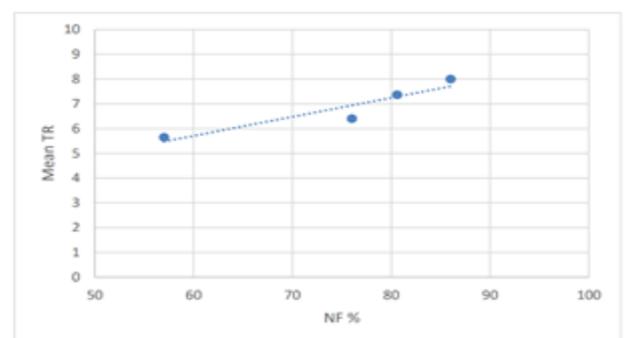


Figure 6. Calculated mean TR plotted against the NF% for the three residences(backyards and frontyards)

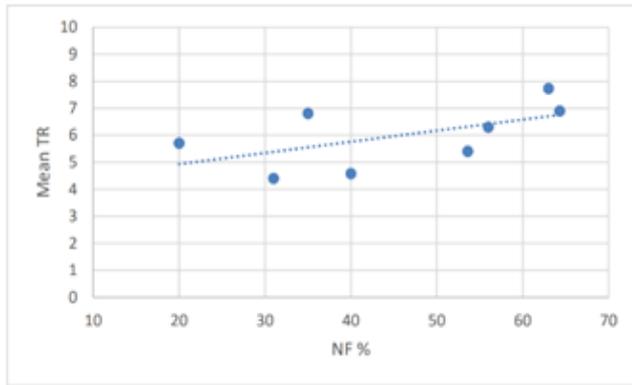


Figure 7. Calculated mean TR plotted against the NF% for the three residences(internal spaces)

Figure 2, Figure 3, Figure 4 and Figure 5 shows that the tranquility level is inversely proportional to the sound pressure levels (LAmax and LAeq). For maximum sound pressure level (LAmax) ranging between 40 – 60 db(A) and between 40 – 70 db(A) for outdoor and internal spaces respectively, the trend of tranquility rating drops down for each increase in the values of sound pressure level. Similarly, for average/equivalent sound pressure level (LAeq) ranging between 35 – 50 db(A) and between 30 – 50 db(A) for outdoor and internal spaces respectively, trend of tranquility rating drops down as the intensity of sound level increases. This gives an idea that if a space is exposed to more amount of man-made noises, the tranquility of the space is reduced and hence the overall spatial quality is degraded and a user may feel disturbed due to the noises instead of experiencing a level of calmness and serenity while exploring the space. The unfamiliar fluctuations in the values of tranquility rating (increased rating for increased sound pressure levels) is due to the fact that it is balanced by the percentage of the natural features in its view. A bedroom or a dining space that is overlooked towards a green space is suppose to be more tranquil than those who aren't.

Figure 6 and Figure 7 shows that the tranquility rating is directly proportional to the percentage of natural features (NF). For the percentage ranging between 50 – 90 % and between 20 – 60 % for outdoor and internal spaces respectively, the tranquility level increases with each increase in the percentage. This trend helps in quantifying and prove the notion that tranquility is related to the amount of 'greenery' that surrounds the place. A space that is welcomed with the elemental character of nature has a positive impact on the user experience about that space and therefore enhances the overall quality of the space.

In spite of high sound pressure levels(>50db) the tranquility rating was good enough (above5) due to the fact that it was balanced by the percentage of natural features in it. This gives an idea that the spatial tranquility was enhanced by creating a

buffer through the plantations which reduced the impact of man-made noises and made the spaces more tranquil for the residents. This shows the role internal landscaping elements play in enhancing the user experience inside the various spaces of an Indian residence. In spite of low percentage of natural features in the internal spaces (<40%) the high level of tranquility is due to the fact that these internal spaces have low level of man made noise due to the careful planning and may be the number and size of openings that are provided in that space. Thus, the natural elements and the level of man-made noises do govern the tranquility of a space and is quantified by using the TRAPT.

4.5 The Survey/questionnaire

A google form survey was conducted as a part of the process which tried to compare the calculated Tranquility rating as mentioned in Table 2 with the viewers response to visual parameters. Survey consisted of a series of photographs of the various spaces of the selected three residences and the viewers were asked to rate the pictures from 0 – 10 indicating the level of tranquility the visible parameters in the photographs provided to them.

More than 100 responses were recorded and the results were compared to the tranquility ratings obtained from the TRAPT, which helped to understand and analyse the validity of the equation for calculating the tranquility of a residential space. Through the survey the rating could be obtained as a range from the drafted graph and the final result is listed in Table 3, by selecting the number from 0 – 10 which received the highest percentage and then compared.

TYPE OF SPACE	CALCULATED TR	TR FROM SURVEY
Residence 1		
Front yard	8	8 - 9
Internal Courtyard	7.73	7 - 8
Drawing+ Living	6.81	6 - 7
Dining + Kitchen	5.7	5- 6
Residence 2		
Front yard	5.65	5 - 6
Living + Dining	4.6	4 - 5
Drawing room	4.58	3 - 4
Bedroom	6.9	6 - 7
Backyard	6.4	5 - 6
Residence 3		
Drawing room	4.4	3 - 4
Dining+Kitchen	5.4	4 - 5
Bedroom	6.3	5 - 6
Backyard	6.4	5 - 6

Table 3 Comparing Calculated TR with survey responses

From the results listed in Table 3 it is observed that the idea of tranquility rating obtained from the viewers response to several visual parameters is similar to the tranquility ratings calculated from the Tranquility Rating Prediction Tool. Although the ratings obtained from survey was limited to a range of whole number value whereas the equation provided ratings up to two decimals however the decimal values can be ignored as there are several limitations to the experiment mentioned in the methodology adopted here. A little ambiguity is observed in the results of ratings specially for interior space, this can be explained by suggesting a point that few percentage of viewers gave a higher rating with respect to the modern and polished finished interiors that they could see in the pictures and considered it as a base for marking the tranquility rating.

However, It can be seen that the calculated tranquility ratings fall under the range obtained from the survey. These conclusions and results validate the application of TRAPT for an Indian residential space and helped in quantifying the tranquility of a space. Hence it provides positive comments on the validity of the Tranquility Rating Prediction Tool and in quantifying and identifying the elements that govern the tranquility of a space.

V. SUMMARY AND CONCLUSIONS

Tranquility as a spatial phenomenon is that challenging part of architecture that requires high level of sensitivity, careful design ideologies, an art more than a science. This work through analysing several Indian architect's work towards tranquility and a verified experimental equation for measuring tranquility explored and analysed the various design ideologies and elements that contribute towards creating tranquil spaces in an Indian residence.

This work attempted to quantify the tranquility of the various spaces found in an Indian residence through the interim verified equation of the Bradford University, the Tranquility Rating Prediction Tool (TRAPT) and hence validated the use of the TRAPT for a residential space through a public survey. This played a vital role in understanding the several parameters that govern the tranquility of the residential space such as the sound levels and the number of natural features present within a space. The analysis suggested the trend of tranquility level with respect to sound levels and the percentage of natural features. The intensity of the man made noises to which the spaces are exposed tend to degrade the tranquility of a space and the amount of greenery and the introduction of the essence of natural elements in the form of light, shadow, colour and texture helps in enhancing the tranquility of the space and thus providing an overall quality of experience that provides

physical as well as mental wellbeing. The study helped in establishing a perspective that a tranquil space is somewhere where the sound and visual components synchronize to create a peaceful balance and the natural factors have a vital role to play in it. This study therefore plays a crucial role to increase the sensitivity towards spatial experiences while designing a residential space and understanding that the mental state despite being a very subjective idea concerned with each individual, there are indeed several architectural elements guiding the manmade built environment that affect the user's psychological needs in a positive way working towards delivering a space that elevates the spatial experience and provide a tranquil, serene and peaceful space to reside in.

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