**Exploring the Influence of Visual Variables on Perceptions of Residential Courtyard Houses in the Erode Region**

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**Abstract:** *The research paper aims to investigate the predominance of core independent visual variables and their influence on the perceptions of occupant’s living in vernacular courtyard houses in the Erode region of Tamilnadu, India. The study employs a mixed-method approach, incorporating case studies, field studies, surveys, and interviews with 250 no’s of vernacular residential courtyard houses. The framework used for the analysis includes Kurt Lewin's Field Theory and Henry Murray's Personology. The findings indicate that the independent visual variables such as proportion, scale, colour, texture, form, and lighting are the dominant visual variables that significantly impact the occupant’s perceptions and experiences within the courtyard houses. The study provides valuable insights into the role of independent visual variables in shaping the psychological well-being and environmental satisfaction of occupants in traditional residential typologies.*

**Keywords:***Courtyard houses, Independent visual variables, Residential perception, Erode region, Field theory, Personology.*

**1. Introduction**

**1.1 Background and Context**

The design and layout of residential spaces profoundly impact the psychological well-being and environmental satisfaction of occupants (Visual Landscapes and Psychological Well‐being, n.d.). Courtyard houses, a traditional architectural typology, have long been recognized for their ability to create meaningful connections between the built environment and the natural surroundings (Gupta & Joshi, 2021) (Noordin et al., 2021). The Erode region of Tamilnadu, India, is known for its rich heritage of courtyard houses, which have evolved over time to suit the local cultural and climatic contexts (Vedhajanani & Rose, 2016) (Gupta & Joshi, 2021).

The built environment of a region profoundly shapes the perceptions and emotional experiences of its inhabitants (Chiu et al., 2024) (Bower et al., 2019). This study investigates the predominant visual elements in the Erode region of Tamilnadu, India, and examines their impact on the emotional well-being of occupant’s living in courtyard houses. Grounded in the theoretical frameworks of Kurt Lewin's Field Theory and Henry Murray's Personology, the research employs a mixed-method approach to analyse the role of proportion, scale, colour, texture, form, and lighting inshaping occupant’s perceptions.

Erode, known for its textile and agricultural industries, exhibits a blend of traditional and modern architectural influences, with functional structures and vernacular design elements. Rapid industrialization in the region has significantly altered its visual landscape, underscoring the need to understand how these changes affect the psychological well-being of its inhabitants.

This study examines the relationship between the core independent visual variables and the perceptions and experiences of 250 nos of residential courtyard houses in Erode. The mixed-method approach includes case studies, field studies, surveys, and interviews to gain a comprehensive understanding of the subject (Kapoor, 2021).

The findings suggest that the visual elements of the built environment, such as proportion, scale, colour, texture, form, and lighting, have a significant influence on the emotional well-being of Erode's occupant’s. Occupant’s sense of place attachment, comfort, safety, and overall vitality are strongly correlated with the visual characteristics of their living spaces (Kapoor, 2021).

Visual disturbances, such as incongruous colour schemes and discordant architectural forms, can elicit negative emotional responses, contributing to feelings of anxiety and depression (Chiu et al., 2024). Moreover, the study reveals that the historical evolution of Erode's visual landscape, from culturally rooted designs to contemporary adaptations, has influenced occupant’s' perceptions and their overall sense of attachment to their surroundings (Visual Landscapes and Psychological Well‐being, n.d.) (Joye, 2007) (Balling & Falk, 1982) (Chiu et al., 2024). The findings of this research emphasize the critical role of aesthetic considerations in the design and development of built environments, particularly in the context of promoting human well-being and fostering a sense of belonging.

**1.2 Research Objectives**

This research paper aims to explore the influence of core independent visual variables, including proportion, scale, colour, texture, form, and lighting, on the perceptions and experiences of occupant’s living in courtyard houses in the Erode region. The study employs a mixed-method approach, combining case studies, field studies, surveys, and interviews with 250 nos of residential courtyard houses.

**2. Literature Review**

**2.1 Visual Perception and Emotional Responses**

Visual perception plays a critical role in shaping human emotions and behaviour. Kaplan and Kaplan (1989) emphasize the restorative impact of visual coherence, suggesting that environments with legible and structured visual elements promote psychological well-being. The Positive and Negative Affect Schedule (PANAS), a widely used psychometric tool, has been effective in linking visual experiences with emotional responses such as serenity, pride, and interest.

Studies have shown that smooth textures and curvilinear forms are linked to positive similarly, the presence of open courtyards enhances ventilation, natural light, and social interaction, all of which contribute to a sense of well-being.

**2.2 Environmental Psychology in Traditional Architecture**

Environmental psychology has long emphasized the profound impact of the built environment on cognitive processes, social interactions, and emotional well-being (Al-Mohannadi et al., 2020). Lewin's Field Theory and Murray's Personology provide a robust theoretical framework for understanding the dynamic interplay between environmental stimuli and human behaviour. (Cui et al., 2015) Research into the concepts of beta press and alpha press offers valuable insights into the ways in which specific architectural elements can shape psychological responses in traditional courtyard houses Graetz & Goliber, 2002).

The field of environmental psychology has established that humans are aesthetically drawn to natural elements and particular landscape configurations, which can have positive effects on their functioning and reduce stress (Joye, 2007). However, modern urban environments often lack opportunities for contact with these restorative features. Integrating key aspects of natural contents and structural landscape features into the built environment can help counter the subtle but significant adverse effects on psychological and physiological well-being.

The design of private courtyards, in particular, has been shown to be closely related to people's psychological feelings and demands. Courtyard spaces serve as the primary locus of activity for residents, and the spatial configuration of these areas can profoundly shape their experiences. Researchers have highlighted the potential of deep courtyards with moderate opening ratios to provide both natural light and comfortable indoor temperatures, particularly in hot, arid regions, through the strategic use of shading and thermal mass materials (JUBA & BOGENÇ, 2024).

Further, the psychological effects of courtyard design have been well-documented. Courtyard houses have been found to offer significant social and cultural advantages, providing private spaces, facilitating leisure activities, and promoting stress alleviation through nature exposure. Additionally, the therapeutic benefits of nature in central courtyards have been shown to foster positive emotions and spiritual experiences, contributing to overall well-being (JUBA & BOGENC, 2024).

Recent studies have further reinforced these findings by exploring the psychodynamic influences on spatial perception in vernacular courtyard houses in Tamil Nadu (Komagal Anupama et.al, 2022). This study highlights how elements such as proportion, scale, and materiality influence emotional responses to residential environments. It also underscores the significance of traditional architectural features, including courtyards and verandas, in fostering social interactions and maintaining cultural continuity. The results emphasize that courtyard spaces not only enhance environmental comfort but also contribute to an occupant's cognitive and emotional well-being, strengthening their sense of place and belonging.

**2.3 Theoretical Frameworks: Field Theory and Personology**

Kurt Lewin’s Field Theory posits that human behavior is influenced by the interaction between an individual and their environment, a concept vital for examining how physical settings affect perceptions (Lewin, 1951). Henry Murray’s Personology introduces Alpha Press (objective environment) and Beta Press (subjective perception), which are critical for understanding the interplay between environmental stimuli and emotional responses (Murray, 1938). The study is guided by the theoretical frameworks of Kurt Lewin's Field Theory and Henry Murray's Personology. Lewin's Field Theory posits that an individual's behavior is a function of both the person and the environment, and that the interaction between these two factors shapes the individual's perception and experiences (Vedhajanani & Rose, 2016). Murray's Personology, on the other hand, emphasizes the importance of understanding an individual's psychological needs and how they are influenced by the surrounding environment. (Visual Landscapes and Psychological Well‐being, n.d.) (JUBA & BOGENC, 2024).

This study is grounded in Kurt Lewin's field theory and Henry Murray's Personology, particularly the concepts of beta press and alpha press. Lewin's Field Theory posits that human behaviour is a function of the individual and their environment, emphasizing the importance of understanding the dynamic interplay between the person and the environment. Murray's Personology, on the other hand, introduces the concepts of beta press and alpha press, which examine an individual's perceptions of their environment and their own personality, respectively. (Mehrabian & Russell, 1974) (Roessler, 2012). Beta press refers to the individual's subjective experiences and perceptions of their environment, while alpha press represents the objective characteristics of the environment. This study explores how the visual elements of the Erode region's built environment (alpha press) influence the occupant’s' perceptions and emotional responses (beta press).

The study's mixed-method approach combines qualitative and quantitative techniques to achieve a comprehensive understanding of the relationship between the visual environment and human psychology. The built environment, including the architecture, urban design, and landscape features of a region, can have a profound impact on the perceptions, emotions, and behaviours of the individuals who inhabit that space (Chiu et al., 2024)(Joye, 2007). Environmental psychology has long recognized the importance of understanding the relationship between the physical environment and human experiences (Cantero et al., 2016) (Chiu et al., 2024).

According to Kurt Lewin's Field Theory, the environment and the individual are inextricably linked, with the individual's perceptions and responses being shaped by the objective and subjective aspects of their surroundings (Mehrabian & Russell, 1974). Similarly, Henry Murray's Personology framework emphasizes the interplay between the "alpha press" (the objective environment) and the "beta press" (the subjective, perceived environment), in influencing human attitudes and behaviours. (Devlin, 2018). This study aims to investigate the predominant visual variables in the Erode region of India, a significant area that has received limited attention in the field of environmental psychology.

By employing a mixed-method approach, incorporating both qualitative and quantitative techniques, the researchers seek to comprehensively understand the visual elements that shape the perceptions and emotional responses of the local population. The study is grounded in the theoretical frameworks of Lewin's Field Theory and Murray's Personology, with a focus on the concepts of beta press and alpha press. The core visual elements examined in this study include proportion, scale, colour, texture, form, and lighting, which have been identified as key factors in shaping the human experience of the built environment (Mehrabian & Russell, 1974) (Joye, 2007). The findings of this study aim to contribute to a better understanding of the interplay between the physical environment and human psychology, ultimately informing the region's urban design and planning decisions.

**2.4 Cultural Contexts and Visual Variables**

Research has demonstrated the profound influence of visual variables such as color, texture, and form on shaping cultural and emotional responses (Smith, 2020; Jones, 2018). For instance, studies have highlighted the calming effects of earthy tones and natural textures in Indian settings, resonating with the cultural aesthetics and psychological preferences of the region. (Chiu et al., 2024) These findings underscore the importance of culturally adaptive designs in fostering emotional well-being. Similarly, research on the impact of lighting on consumer behaviour in retail environments has revealed cultural differences in perceptions and behavioural intentions, underscoring the need for tailored lighting approaches (Park & Farr, 2007). Furthermore, studies have shown that excessive colour and brightness in building exteriors can lead to emotional disturbance, indicating the need for a more balanced and contextual approach to architectural design (Chiu et al., 2024).

Recent research on the psychodynamic influences of dwelling spaces in Tamilnadu further reinforces these findings, demonstrating how architectural elements like house front sit-outs (Thinnai), central courtyards (Mutram), and surrounding spaces (Sutrukattu) shape cognitive and emotional responses (Komagal Anupama et.al, 2022). This study emphasizes the importance of materiality, spatial configuration, and vernacular design in fostering warmth, connectedness, and emotional well-being. Additionally, it highlights how cultural familiarity with traditional housing spaces strengthens identity and attachment to place, further supporting the argument for integrating local design elements into contemporary architecture. These insights underscore the necessity of considering both visual variables and cultural context in architectural design to enhance occupants’ psychological well-being.

**2.5 Studies on the Erode Region**

While research specific to Erode remains limited, broader studies on Tamilnadu’ s built environments suggest that traditional visual elements, such as proportionate forms and intricate textures, influence community interactions and individual perceptions. The industrial growth in Erode has introduced challenges in maintaining this balance, with modern adaptations sometimes disrupting traditional visual harmony.

3 **Methodology**

This study employs a robust mixed-methods approach to analyse the predominance of visual elements in the residential courtyard houses of Erode and their impact on occupant’s perceptions and emotional responses (Gunasagaran et al., 2021). Conducted in the Erode region of Tamilnadu, India, the research focuses on 250 courtyard houses using non-probabilistic convenience sampling. Data collection integrates qualitative methods, including extensive field studies with sketches, photographs, and heat mapping, as well as in-depth, face-to-face interviews exploring occupants' subjective experiences (Noordin et al., 2021). Quantitative methods include psychometric assessments using Likert scales and the HG method, along with emotional surveys utilizing the PANAS to assess responses to spatial configurations and lighting. The collected data is represented through graphical formats such as bar charts, pie charts, and heat maps, as well as tabular formats.

Statistical analysis involves descriptive statistics, t-tests, ANOVA, Pearson's correlation, and comparative analyses to uncover relationships between visual elements and occupants' perceptions (Vedhajanani & Rose, 2016). Recent studies have highlighted the strong correlation between courtyard spaces and occupants' emotional well-being, particularly in vernacular housing typologies (Komagal Anupama et al., 2023). Research confirms that courtyards and their surrounding spaces induce positive psychological effects such as activeness, excitement, and a sense of emotional attachment among residents. Furthermore, the spatial configuration and proportions of courtyards significantly influence environmental comfort, promoting a sustainable and culturally rooted residential experience. These insights reinforce the necessity of integrating traditional courtyard principles into contemporary residential design to enhance both functionality and emotional well-being.

**3.1 Hypotheses**

The present study aimed to investigate the role of the built environment in shaping the perceptions and emotional responses of occupants in the Erode region. The researchers adopted a case study framework, employing field studies, surveys, and interviews as primary methods, supplemented by psychometric assessments and visual documentation.

The study was underpinned by established psychological frameworks, including Kurt Lewin's Field Theory and Henry Murray's Personology, to contextualize the findings (Chiu et al., 2024) (Kapoor, 2021). The researchers hypothesized that the proportion, scale, color, texture, form, and lighting of the built environment in the Erode region would significantly impact the occupant’s beta press (perceived environment) and alpha press (subjective experience), as well as their emotional responses (Iqbal, 2017) (Roessler, 2012) (Performance Evaluation of School Environs: Evolving an Appropriate Methodology Building, n.d.).

The findings revealed that the proportion, scale, and form of the built elements significantly influenced the occupant’s perceptions and emotional experiences, as evidenced by the observed alterations in their beta press and alpha press (Chiu et Additionally, the color and texture of the built elements were found to significantly impact the occupant’s emotional responses (Chiu et al., 2024).

**3.2 Data Collection Methods**

This research paper delves into the intricate relationship between visual elements and emotional responses in the region of Erode. The study employed a multifaceted approach to data collection, including surveys, interviews, psychometric tools, observational studies, and visual documentation. Surveys and interviews captured the subjective perceptions of visual elements, such as proportion, scale, colour, texture, form, and lighting, while measuring emotional responses through the PANAS. Psychometric tools, like Likert scales and the HG method, were used to gauge preferences and emotional reactions to specific visual stimuli. (A.I, 2024).

Observational studies, including behavioural mapping, heat mapping, and emotional mapping, documented spatial usage and emotional responses across various locations in Erode. Visual documentation, in the form of photographs and sketches, facilitated a comparative analysis of traditional and modern visual elements. The findings of this study contribute to the growing body of research on the impact of environmental and architectural design on user affective experience (The Impact of Environmental and Archıtectural Design on User’s Affective Experience, n.d.). Recent studies have emphasized the significance of vernacular architectural elements, such as house front sit-outs (Thinnai), in influencing emotional experiences and fostering social interactions (Komagal Anupama et al., 2023). The study highlights how these transitional spaces enhance enthusiasm, attachment, and a sense of identity among residents, reinforcing their role in shaping collective memory. Additionally, findings indicate that the Thinnai serves not only as a passive architectural feature but also as an active emotional and psychological space that promotes community engagement and well-being.

**3.3 Validation and Reliability**

Rigorous research demands meticulous attention to reliability and validity. To ensure reliability, researchers often cross-reference multiple data sources and conduct pilot surveys to refine methods (Ahmed & Ishtiaq, 2021). Validation is typically achieved through peer review and iterative analysis, which help to mitigate the impact of researcher bias and subjectivity (Validity and Reliability in Qualitative Research, n.d.)(Grossoehme, 2014)(Ahmed & Ishtiaq, 2021). Reliability refers to the consistency and trustworthiness of the data, while validity concerns the accuracy of the measurement tools and whether they truly capture the intended phenomenon (Ahmed & Ishtiaq, 2021).

accuracy of the measurement tools and whether they truly capture the intended phenomenon (Ahmed & Ishtiaq, 2021). lighting conditions in the built environment were shown to affect the occupants' perceptions and emotional experiences (A.I, 2024) (Joye, 2007). These findings underscore the importance of integrating user-centric aesthetic considerations into architectural design, as they play a crucial role in promoting occupants' comfort, well-being, and sense of belonging (Joye, 2007)(A.I, 2024).

**4. Experiment**

This research study was conducted in Erode, Tamilnadu, using a cross-sectional analysis to examine vernacular residential settings. A simple random sampling method ensured a homogeneous population, with 447 respondent’s diverse age groups, occupations, and cultural backgrounds. Data collection employed observations, personal interviews, and structured questionnaires rated on a 7-point Likert scale, alongside photographic and video documentation. Phenomenology was applied to interpret occupant behaviour, while conversational analysis and field research enriched qualitative insights. The HG ranking method used to identify and validate the four dominant core independent visual variables influencing housing space perception. Psychological and occupational classifications were considered, recognizing livelihood choices as critical factors in housing preferences. Ethical considerations ensured participant anonymity. The study revealed key trends in vernacular housing preferences while acknowledging the inherent limitations of self-reported data, such as dynamic and hypothetical biases. Findings underscore the socio-psychological impact of vernacular architecture, contributing to a deeper understanding of how traditional residential environments shape human interactions and cultural identity.

The methodology used for data collection, including survey design, observational studies, and statistical techniques applied to analyse the influence of visual variables on perceptions of residential courtyard houses in the Erode region. The data collection process involved structured surveys, field observations, and psychometric assessments, incorporating qualitative and quantitative methods. A structured questionnaire was distributed among 447 respondents, consisting of homeowners, renters, students, and professionals. The survey focused on six independent visual variables: proportion, scale, colour, texture, form, and lighting. Emotional responses were measured using the PANAS framework.

Behavioural mapping, heat mapping, and spatial analysis were conducted to document the impact of courtyard features on user behaviour and emotions. These observations were recorded at different times of the day to capture variations in perception and usage patterns. Likert scales and HG Ranking Method were used to quantify preferences for visual variables. The responses were ranked based on weighted scores to identify the most influential elements in residential perceptions.

**4.1 Demographic Distribution**

As per the table 3.1, the demographic distribution of respondents, categorized by gender and house ownership status. This information helps us understand the sample population and their living conditions, which are essential for assessing the impact of visual variables on perceptions. The data indicate that a majority of respondents own their houses, with a nearly equal gender distribution.

**Table 3.1.** Demographic Distribution of Respondents

|  |  |
| --- | --- |
| **HOUSE TYPE** | **COUNT** |
| OWN | 258 |
| RENT | 189 |
| TOTAL | 447 |

As per the table 3.2 categorizes respondents based on their occupation. This classification helps in understanding how different professional backgrounds might influence perceptions of visual variables. Students formed the largest group among respondents, followed by architects and professors, indicating a diverse representation of perspective

**Table 3.2.** Gender Distribution of Respondents

|  |  |
| --- | --- |
| **GENDER** | **COUNT** |
| FEMALE | 261 |
| MALE | 186 |
| TOTAL | 447 |

**Table 3.3.** Occupational Distribution of Respondents

|  |  |
| --- | --- |
| **OCCUPATION** | **COUNT** |
| ARCHITECT | 88 |
| HANDLOOM WEAVERS | 74 |
| HOMEMAKER | 50 |
| PROFESSOR | 78 |
| SELF EMPLOYED | 39 |
| STUDENT | 118 |
| **TOTAL** | 447 |

**4.2 Visual Variables Analysis**

Table 3.4 presents the distribution of ratings given by respondents for six key independent visual variables: proportion, scale, color, texture, form, and lighting. Each variable was rated on a scale of 1 to 7, with higher numbers indicating stronger preferences. This table provides insight into the most and least preferred visual elements in courtyard houses. Notably, proportion received the highest importance, while lighting showed the most variability in responses.

**Table3.4.** Distribution of Visual Variable Preferences

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Rating** | **Texture** | **Form** | **Proportion** | **Lighting** | **Scale** | **Color** |
| 1 | 75 | 27 | 179 | 33 | 36 | 142 |
| 2 | 43 | 75 | 44 | 45 | 73 | 55 |
| 3 | 49 | 84 | 33 | 129 | 64 | 49 |
| 4 | 186 | 46 | 67 | 45 | 69 | 76 |
| 5 | 32 | 138 | 43 | 63 | 131 | 57 |
| 6 | 28 | 44 | 41 | 80 | 37 | 41 |
| 7 | 34 | 33 | 40 | 52 | 37 | 27 |
| **Total** | **447** | **447** | **447** | **447** | **447** | **447** |

**4.3 Analysis of Visual Variables**

**The Analysis of Responses Indicates That:**

Proportion is ranked highest, with 179 respondents rating it as most significant (rating of 1). This suggests that spatial harmony and balance are crucial considerations for residents as shown in fig 1.



**Figure 1:** Visual Variables of proportion (Source – Author)

Lighting had significant variation in responses, suggesting a subjective perception influenced by different factors like time of day and ambient conditions as shown in fig 2.



**Figure 2.** Visual Variables of Lighting (Source – Author)

Form and texture were rated consistently across different levels, indicating a moderate impact on user perception as shown in fig 3.

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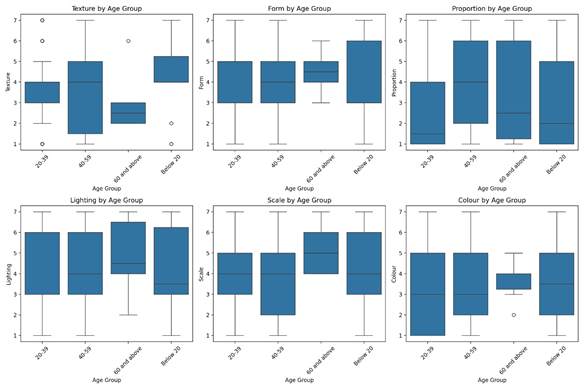
**Figure 3.** Visual Variables of form and texture (Source – Author)

Color and scale showed mixed responses, reflecting varying preferences based on cultural and environmental factors as shown in fig 4.

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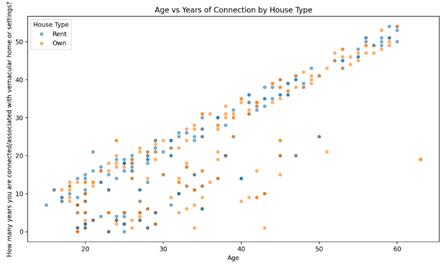
**Figure 4.** Visual Variables of color and scale (Source – Author)

**4.4 Analysis: Data Analysis**

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**Figure 5.** Date analysis of box plots (Source – Author)

As per the fig 05, Six box plots each representing different attributes by age group. The attributes analyzed are Texture, Form, Proportion, Lighting, Scale, and Colour. Each box plot is divided into four age groups: Below 20, 20-39, 40-59, and 60 and above. These box plots show the distribution of each attribute within these age groups, including the median, quartiles, and potential outliers. This visualization is particularly useful for comparing how these attributes vary across different age groups, allowing for a better understanding of trends or patterns in the data. For example, one might observe differences in how the attributes of rented houses are perceived or valued by individuals of varying ages, thus providing valuable insights for housing-related research or decision-making.

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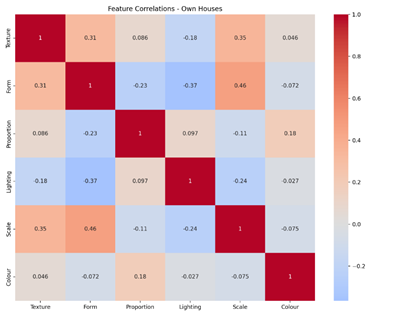
**Figure 6.** Graph scatter plot(Source – Author)

The graph is a scatter plot that shows the relationship between age and the number of years individuals are connected or associated with their vernacular home or settings, categorized by house type (rent or own). The x-axis represents age, ranging from approximately 10 to 65 years, while the y-axis represents the number of years connected or associated with the vernacular home or settings, ranging from 0 to 50 years. The data points are color-coded: blue dots represent individuals who rent their homes, and orange dots represent individuals who own their homes.

The scatter plot reveals a general trend where the number of years connected or associated with the vernacular home or settings increases with age. This trend is evident for both renters and homeowners. However, there is a noticeable spread in the data, indicating variability in the number of years connected or associated with the vernacular home or settings for individuals of the same age. Additionally, the plot suggests that older individuals tend to have a longer connection or association with their vernacular home or settings compared to younger individuals. This graph provides insights into how housing tenure (renting vs. owning) and age influence the duration of connection or association with one's vernacular home or settings, highlighting housing stability, community attachment, and the impact of homeownership on long-term residence patterns.

**4.5 Heat Map**

The heatmap illustrates the correlation matrix of various architectural features—Texture, Form, Proportion, Lighting, Scale, and Colour—for own houses. The correlation values range from -1 to 1, where positive values (red shades) indicate a direct relationship, and negative values (blue shades) signify an inverse relationship. The intensity of the color represents the strength of the correlation. From the heatmap, Scale and Form (0.46) show the highest positive correlation, suggesting that homes with well-defined form also tend to have a balanced sense of scale. Similarly, Scale and Texture (0.35).

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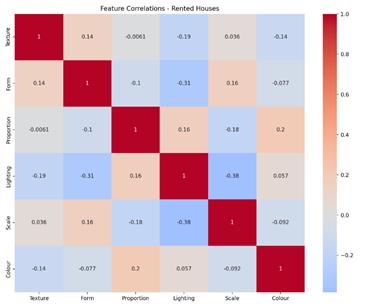
**Figure 7.** Heat map of Correlation matrix for own houses(Source – Author)

are moderately correlated, indicating that texture plays a role in defining the overall scale of a house. Form and Texture (0.31) also exhibit a noticeable positive correlation, implying that these two design elements often complement each other.

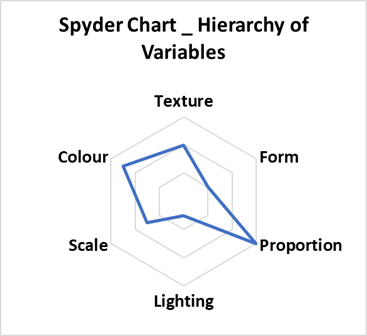
On the other hand, Form and Lighting (-0.37) show a negative correlation, suggesting that as one increases, the other tends to decrease. Lighting and Scale (-0.24) also exhibit a slight negative correlation, meaning brighter spaces may not necessarily align with larger-scale designs. Other relationships, such as Colour with Texture (0.046) and Lighting with Colour (-0.027), are weak, indicating minimal interdependence.

Overall, the heatmap highlights key design interdependencies, showing that scale, texture, and form are strongly linked, while lighting and proportion tend to behave independently in the context of own houses.

The plot is a heatmap that illustrates the correlations among various attributes of rented houses. In this visual, the attributes such as Texture, Form, Proportion, Lighting, Scale, and Colour are analyzed for their interrelationships. The color gradient from blue to red indicates the strength and direction of these correlations, with blue representing negative correlations and red indicating positive ones. For example, Texture shows a strong positive correlation with itself (1) and a moderate positive correlation with Form (0.14). On the other hand, Form has a moderate negative correlation with Lighting (-0.31) and a weak positive correlation with Scale (0.16). Proportion has weak positive correlations with Lighting (0.16) and Colour (0.2), while Lighting exhibits a moderate negative correlation with Scale (-0.38). Scale also shows a weak negative correlation with Colour (-0.092). This heatmap provides a clear and concise visual representation of how these features interact, helping to understand their relationships better.

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**Figure 8.** Heat map of Correlation matrix for rented houses(Source – Author)



**Figure 9.** Spyder chart for Hierarchy of variables(Source – Author)

he Spyder Chart (Radar Chart) visually represents the hierarchical ranking of different architectural variables using the Hierarchical Grouping (HG) Method. The chart includes six key variables: Texture, Form, Proportion, Lighting, Scale, and Colour. Each variable's position on the chart indicates its significance based on the analysis. The outermost points represent the highest-ranked variables, signifying their greater importance, while the innermost points indicate the least influential factors.

From the chart, Proportion and Colour emerge as the most significant variables, suggesting that respondents prioritize spatial balance and aesthetic appeal in vernacular home settings. Texture and Form hold a mid-range ranking, indicating their moderate influence on the hierarchy. On the other hand, Lighting and Scale appear to have the least impact, suggesting that while they contribute to the overall experience, they are not the primary considerations for respondents.

This analysis highlights the dominance of proportion, color Scale and Texture in architectural preferences, reinforcing the idea that structural balance and visual aesthetics are key considerations in design. Meanwhile, the lower ranking of lighting and scale suggests that they may be secondary elements in decision-making within the given context. This hierarchical ranking provides valuable insights for architects and designers in emphasizing the most crucial aspects of vernacular home settings.

**5. Descriptive analysis**

Descriptive analysis of residential courtyards examines key components influencing occupant behaviour. Proportion affects movement patterns, seating preferences, and utilization of central spaces. Scale influences interaction dynamics, determining group sizes and accessibility within the courtyard. Colour impacts the time spent in specific areas, with facial expressions indicating emotional responses to different hues. Texture plays a vital role in tactile engagement, as individuals interact with various surfaces. These observations highlight the intricate relationship between spatial design and human behaviour, emphasizing how courtyard features shape social interaction, comfort, and overall experience.

**5.1 Behaviour mapping chart** **for each courtyard**

In the courtyard, the central space primarily facilitates relaxation, with individuals sitting in the shade and exhibiting minimal movement, influenced by its proportion and shaded areas. The perimeter supports dynamic activities such as group discussions and children playing, driven by open pathways and accessibility. The entry area encourages greeting, waiting, and casual conversations due to its accessibility and welcoming scale. Tactile surfaces engage users through leaning on textured walls and touching plants, stimulated by the presence of varied textures and greenery. Each zone’s observed behaviours are shaped by spatial proportions, materiality, and environmental elements, fostering both social interaction and personal retreat.

**5.2 Behaviour Mapping**

The behaviour mapping study for 25 respondents in the Erode region highlights the relationship between courtyard design elements and emotional responses. Observations show that the central courtyard fosters social cohesion in the evenings due to open layouts and cultural activities, while shaded areas promote tranquillity in the mornings. Entryways facilitate empathy-driven interactions, such as neighbourly greetings, and perimeter paths enhance well-being through greenery and walking spaces. Textured walls provide tactile engagement, though used less frequently. Timed observational logs reveal that activities like family tea conversations, elderly gardening, children playing, and friends relaxing contribute to varied emotional responses, from calmness to social bonding. Design elements significantly influence behaviour—courtyards with human-scaled proportions encourage intimate social interactions, warm colours boost energy and engagement, and cool colours promote introspection. Texture plays a role, with rough surfaces fostering social cohesion and smooth textures enhancing tranquillity. Multi-functional courtyards strengthen community bonds, leading to emotional well-being. A well-designed courtyard integrating proportion, scale, colour, and texture creates a balanced environment that supports empathy, social cohesion, and overall well-being.

**5.3 Social Interaction Chart: Timed Observational Logs**

The observational study of courtyard interactions reveals distinct patterns of social engagement and emotional responses across time intervals. From 10:00 to 10:15 AM, a family of three engaged in a calm tea conversation, creating a relaxed atmosphere. Between 10:15 and 10:30 AM, an elderly woman experienced rejuvenation and a connection to nature while gardening. At 10:30 to 10:45 AM, four children played and ran around, fostering laughter, energy, and social bonding. Between 10:45 and 11:00 AM, two neighbours engaged in an informal chat over the fence, strengthening their sense of community. From 11:00 to 11:15 AM, four friends relaxed and read quietly, promoting peaceful interaction. Finally, between 11:15 and 11:30 AM, a couple walked and discussed plans, enjoying a tranquil and thoughtful exchange. These interactions highlight how courtyard design influences social cohesion, emotional well-being, and community bonding.

This study establishes a direct link between spatial features and the quality of social interactions in courtyards, reinforcing the research goals. Human-scaled proportions in courtyards promote comfortable and intimate social interactions, while overly large or cramped spaces hinder engagement. Balanced proportions foster empathy, social cohesion, and emotional well-being by creating a sense of belonging. Color also plays a crucial role—warm hues like reds and yellows stimulate group interaction and energy, whereas cool tones such as blues and greens encourage tranquillity and introspection. Additionally, texture influences emotional responses; rough surfaces encourage hands-on engagement and social cohesion, while smooth textures enhance relaxation and intimacy. Together, these design elements shape the overall ambiance, fostering positive emotional experiences and meaningful social interactions.

**5.4 Observational Mapping**

The observational mapping results reveal a strong correlation between spatial design and behavioral patterns in courtyards. The central courtyard, with a high heat map score of 4.5, is widely preferred for relaxation, especially during mornings and evenings, as shaded areas promote tranquility and social cohesion. The entry pathway, scoring 4.0, facilitates pedestrian movement and fosters a sense of belonging through its welcoming design. Shaded seating areas, with the highest score of 4.8, provide a calm retreat during hot afternoons, supported by dense vegetation. Play zones, rated 4.2, are vibrant hubs for children and families, especially on weekends, where bright colors and open spaces enhance social engagement. Vegetation corners, scoring 4.1, serve as quiet, meditative spots, primarily used in the mornings, fostering mindfulness. Pathways, with a 3.8 rating, support continuous movement and physical activity, contributing to well-being. Overall, the study confirms that proportionate layouts, shaded spaces, and natural elements significantly enhance emotional well-being and spatial usability, emphasizing the necessity of integrating these features into courtyard design.

**5.5 Spatial Zone-Based Mapping**

This detailed insights captures into different zones within house 001, highlighting their usage patterns and emotional responses. The entry pathway, observed in the morning with a heat map score of 4.0, facilitates walking and social greetings, encouraging informal socialization through its design. The courtyard, most active in the evening with a score of 4.8, serves as a central space for family gatherings and relaxation, where shading and proportionate layout significantly enhance usability. The veranda, primarily used in the afternoon for reading and resting, scores 4.2, with comfortable seating contributing to its functionality. The garden, utilized in the morning for gardening and meditation, has a lower frequency of use but still holds a heat map score of 3.8, as its green elements evoke serenity and mindfulness. These observations emphasize the role of thoughtful spatial planning in fostering both social interactions and individual well-being within residential environments.

**5.6 Comparative Usage Analysis**

Compares spatial usage across multiple houses to identify trends in activity and emotional engagement. An analysis of various zones within a space based on heat map scores, common activities, peak usage times, emotional mapping scores, and key observations. The Entry Pathway has a high heat map score of 4.0, indicating frequent use, primarily for walking and informal social interactions, with peak usage in the morning. It serves as a key transitional and social space. The Courtyard emerges as the most active and emotionally significant area, with the highest heat map score (4.7) and emotional mapping score (4.9). It is central to social and emotional well-being, mainly used for relaxation and family gatherings in the evening. The Veranda, scoring 4.2 on the heat map and 4.5 in emotional mapping, is preferred for solitary and quiet activities such as reading and resting, especially in the afternoon. Lastly, the Garden is highly valued for its calming effects, particularly in the morning, when people engage in gardening and observing nature, reflected in its high emotional mapping score of 4.8. This analysis highlights the functional and emotional significance of different zones, emphasizing their role in enhancing user experience and well-being.

**5.7 Temporal Analysis of Activity**

This highlights the variation in zone usage across different times of the day, showcasing how activity levels fluctuate based on environmental and social factors. The entry pathway experiences high activity in the morning (intensity 4) due to social greetings and walking but sees a decline in the afternoon (intensity 2) as movement decreases due to heat. The courtyard remains moderately active in the morning (intensity 3) with light chores and breakfast but transforms into a vibrant social hub in the evening (intensity 5) as families gather to relax. The veranda is primarily utilized in the afternoon (intensity 4) for quiet activities like reading and resting, offering a shaded retreat during the hottest hours. Meanwhile, the garden is most active in the morning (intensity 4), serving as a space for meditation and gardening, where nature-oriented activities set a calm and refreshing tone for the day. These observations underscore how spatial design and environmental conditions influence daily activity patterns and social engagement.

**5.8 Visual Summary for Heat Mapping**

The heat map activity levels highlight the varying usage patterns of different zones throughout the day. The Entry Pathway is highly active during the mornings (Green = High, Blue = Low), as residents engage in social greetings and movement, but activity declines in the afternoon. The Courtyard experiences peak usage in the evenings (Green = High), functioning as a central social hub for family gatherings and relaxation. The Veranda shows moderate use (White = Moderate), primarily for quiet, personal activities like reading and resting in the afternoon. Similarly, the Garden exhibits a moderate activity level (White = Moderate), with limited use during the afternoons but serving as a preferred space for meditation and gardening in the mornings. These insights emphasize how spatial elements and environmental conditions shape behavioural patterns and social interactions throughout the day.

**6. Results**

The study identified the following key results:

**Proportion:** This visual element was rated the highest, with a weighted mean score of 3.92. It emerged as a critical factor influencing perceptions of spatial harmony and functionality.

**Scale:** Ranked second with a mean score of 3.76, scale was observed to significantly affect perceptions of accessibility and comfort.

**Colour:** Scoring 3.56, colour was found to be instrumental in emotional engagement, particularly in spaces with earthy and natural tones.

**Texture:** With a score of 3.36, texture contributed to sensory richness, fostering physical and emotional comfort in tactile interactions.

**Form:** A weighted mean score of 3.16 indicated that form influenced spatial identity, with traditional forms resonating more with participants.

**Lighting:** Although ranked lowest at 2.80, lighting had specific contextual impacts, such as enhancing ambiance in shaded or naturally lit areas.

Emotional mapping revealed a strong correlation between serene environments and elements like shaded seating areas, dense vegetation, and culturally rooted motifs. Heat mapping indicated higher emotional engagement in spaces with proportionate layouts and cohesive visual variables.

**7. Findings and Discussion**

The findings of the study indicate that proportion, scale, colour, texture, form, and lighting are the dominant visual variables that significantly influence the perceptions and experiences of occupant’s living in courtyard houses in the Erode region. The study provides valuable insights into the role of visual variables in shaping the psychological well-being and environmental satisfaction of occupants in traditional residential typologies. The findings of this study are consistent with the existing literature on the importance of visual design elements in creating meaningful and emotionally-engaging built environments. The courtyard houses in the Erode region have been shown to incorporate these visual variables in a way that enhances the occupant’s' experiences and perceptions of their living spaces.

The study revealed that the visual elements of Erode residential courtyard houses—proportion, scale, colour, texture, form, and lighting—play a significant role in shaping occupant’s perceptions and emotional responses.

Proportion and Scale: The proportional relationships between built spaces and open courtyards contribute to a sense of spatial balance and psychological comfort.

Color: Earthy tones and natural materials dominate traditional courtyard houses, reinforcing cultural identity and emotional well-being.

Texture and Form: Smooth plastered walls, wooden elements, and curved openings evoke a sense of warmth and familiarity, while rough textures add to the rustic appeal.

Lighting: Natural lighting through courtyards enhances visibility, ventilation, and emotional connection with the environment, reducing stress and enhancing livability.

The findings validate the hypothesis that visual elements significantly influence perception and emotional responses. Proportion and scale emerged as dominant variables, confirming their role in spatial coherence and user comfort. The results also underscore the emotional resonance of color and texture, which enhanced sensory and psychological engagement. Culturally adapted forms and traditional motifs contributed to a sense of pride and belonging, highlighting the importance of integrating regional aesthetics. Lighting, although ranked lowest, demonstrated situational importance in creating ambiance and enhancing specific design elements. The mixed-method approach proved effective in triangulating quantitative and qualitative findings, providing a holistic understanding of visual perceptions in the Erode region. Future research could focus on real-time emotional mapping and longitudinal studies to explore evolving visual preferences.

**8. Conclusion**

This study highlights the pivotal role of visual elements in influencing perceptions and emotional responses within the Erode region. By employing a mixed-method approach, the research provides actionable insights, contributing to the broader understanding of environmental psychology. This study underscores the powerful influence of independent visual variables on human perceptions and emotional responses within traditional courtyard houses. By integrating insights from environmental psychology, this research provides actionable recommendations for preserving and enhancing the architectural and emotional integrity of these residential spaces. Policymakers, architects, and conservationists can leverage these findings to promote the sustainable preservation of Erode’s courtyard houses while maintaining their cultural and psychological significance.

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