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Assessing the impact of socio-demographic factors on spatial recognition in the city of Galle

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Abstract

Visual perception acts as a major intellectual process that determines how people acquire and process elements of cities and their interpretations. Urban planners, along with designers, use knowledge about the spatial perception of the users to develop plans that enhance the clarity of space and strengthen the identity of the city, and improve navigation. Within spatial cognition, people mentally reflect both physical structures and spatial connections, as landmarks take a significant part in forming how the city appears to citizens. Different urban situations present diverse environmental features that call for an assessment of recognition patterns between diverse user groups, along with the impact of building attributes on these recognition patterns. The study examines the perception of urban landmarks in Galle city through mental representation analysis of structural features obtained from user survey data. Users of the city participated in this research to identify important landmarks they recalled while the study examined their recognition patterns according to their nationality, religion, age, gender and length of stay, and their familiarity with the city. The research combines qualitative and quantitative methods which enable investigators to evaluate how often people recall landmarks while also determining their ordering position. The research shows that user characteristics affect landmark recognition. The results demonstrate substantial differences between people based on their nationality and religion and age and period of stay. This research did not show any important relationships between participant characteristics such as gender and their connection to familiar places. The combination of crowded transportation sites and noteworthy open areas together with major public buildings turned out to be the landmarks people remembered most often which illustrates how these places influence city awareness. This research highlights the importance of socio-demographic sensitivity in urban planning by analyzing user insights of landmarks. The findings help planners design accessible, memorable, and navigable cities that caters to diverse residents.

Keywords: Landmarks, landmark hierarchy, public image, recall frequency, spatial cognition

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Introduction

Within the mind of an inhabitant, cities are external and yet internal at the same time. Visual, tactile, auditory, olfactory, and kinetic inputs influence how humans perceive the environment (Szczepańska et al., 2013). Visual perception is dominant in the human mind for collecting city elements. Moreover, it is widely accepted that understanding how urban users perceive their surroundings is crucial for urban planners (Constantinides et al., 2021, Askarizad & He, 2022). In urban design, legibility is a fundamental concept that shapes the overall mental image formed by an observer about a place. According to Lynch (1960), legibility arises from the ability of a place to evoke a clear mental picture while being supported by its underlying physical qualities and spatial structure.

The presence of landmarks is one form of city identity. Most legible urban environments consist of five imageable elements: paths, nodes, edges, districts, and landmarks. In terms of the image of the city, landmarks dominate the urban environment for their structuring and visual identification (Abeynayake et al., 2022). For navigation, people associate with objects that have exceptional characteristics such as landmarks (Quesnot & Roche, 2015). Landmarks serve as anchor points for the city and help citizens navigate by influencing their spatial cognition. Most people in cities self-navigate, concentrating on the physical aspect of one of the dimensions of urban symbols. Some of the landmarks of a city are distinctive because of their pronounced elements. The identity or symbol, which theoretically embodies the genuine essence of the people and the features of the area, fosters a relationship with the society known as place attachment, and it represents the cultural meaning of the inhabitant and place (Damayanti et al., 2020).

Visual, structural, and semantic are the main properties of landmarks. (Sorrows & Hirtle, 1999b; Quesnot & Roche, 2015; Damayanti & Kossak, 2016). The visual and structural properties consider the physical aspects, and the semantics consider the intangible and emotional values of the observer and their experiences in memory. The visual properties of the landmarks are distinct from the other urban elements in respect of facades, scale, and colour, while the structure is a wider pattern that relates to other urban elements in the urban environment. According to many scholars, it is commonly believed that the highly visible elements are getting more attention (Lynch, 1960). Yet many scholars revealed that the priority element of imageability is based on the meaning and the knowledge of the inhabitant (Damayanti & Kossak, 2016; Quesnot & Roche, 2015). Mostly, the landmarks are described according to their intrinsic character and location of the landmarks (Quesnot & Roche, 2015).

Sri Lanka intends to make tourism-based cities for cultural and economic growth (Abeyweera & Kaluthanthri, 2018). Thereby the government and local authorities are in the process of managing and designing the image of the city to create intercity competitiveness and promote the city as a center for international events, demanded by many investors and tourists. Therefore, in order to maintain the unique city image, it is necessary to brand the city. As most Sri Lankan cities are socially dominated by diverse cultures and ethnicities, it is reasonable to study whether the background of the inhabitant is influencing the image of the city. From the perspective of the inhabitant, what sort of attributes influence human cognition in recognizing the image of the city?

Most environmental cognition research has focused on visual and spatial attributes. Environmental cognition accounts for both internal and external variables. Cognition represents the internalized reflections and the representation of the structure, and relations of space (Moore, 1979). Environmental cognition is important for a city or a place to brand the city, and identity to make a pleasurable environment for both inhabitants and visitors.

Many scholars studied visual and structural salience because it was easily measured and identifiable. Yet the semantic salience is based on the spatial experiences of the inhabitant and relies on subjective indicators that are difficult to assess. Several studies have been conducted to investigate the meaning of the environment, sacred meaning, and unique perceptual characteristics for evoking the image (Silva, 2011). However, associational attributes have been neglected, especially the background of the respondent, and cultural and ethnic influences of the inhabitant are less considered.

Spatial working memory of people, spatial cognitive strategy, and mental representations are influenced by culture, which is a notion that includes identity, language, education, lifestyle habits, etc (Tian et al., 2022). Different cultural backgrounds lead to varying degrees of spatial aptitude in individuals. According to Jacobs (2011), biological, cultural, and internal coherences of people significantly impact imageability.

The study determines whether there is a significant difference between the socio-demographic characteristics of the users of a city when recognizing the spatial elements and building attributes. Generalizability is a key component of urban planning, and this study also re-evaluate the original building attributes by Appleyard for Galle city to determine the user perspective. The empirical study was conducted in Galle city due to its cultural, and architectural diversity.

The imageability of the city is triggered by the perceptions and cognition of people. The idiosyncratic relevance of the objects is different from the experiences and personal significance of the observers. Thus, understanding the influence of cultural, and demographic factors of the people on recognition of the city through public image is important to inquire about the differences in the cities.

Even though many of the studies are focused on environmental cognition, thus far limited studies have considered bridging cognitive studies with user characteristics in urban planning and design. Initiators, managers, planners, and social scientists are professionals who interpret changes in the physical environment and social perceptions (Appleyard, 1979). Therefore, identifying the perception of the people regarding the structural image of the city is required for the development of the city to back up and refine the results to establish guidelines for adaptation of landmarks in the future.

Kevin Lynch (1960) in his seminal study on The Image of the City defines the image as a result of a two-way process between the observer and his environment. The idea of imageability defines the representation of the mental map of those who experience the city. Idiosyncratic images of the city may be held by individuals, yet the shared version of the city image is used to guide the city design. Depending on the background and the needs of the person, human interactions differ from person to person. Image is a by-product of immediate sensation and memories (Lynch,

1960). According to Lynch highly imageable places evoke a strong image and create a memory of the place in cognition. An imageable environment has three components: identity, structure, and meaning. Notable elements in the city environment refer to identity, spatial relations of the urban environment or structure, and the meaning which represent the symbolic content and the associates of the environment. According to the Lynchian theory, both identity and structural attributes evolve the image of the city. Also, the sense of place establishes the relationship between the observer and the surrounding environment and builds emotional security and familiarity with the observer (Lynch, 1960). According to Nasar, (1990) and Nasar (1994) the strong feeling and familiarity recall the places in the city.

In 1969 Appleyard investigated the building landmarks and the analysis of the building landmarks revealed the significant quality of form, visibility, and meaning (Appleyard, 1969). Later in 1976, Appleyard extended his study of the physical aspects of the structures to sociocultural aspects of the structures in influencing the memory of the landmarks and the buildings (Appleyard, 1969 1976).

Kaplan, (1979) introduced five building characteristics to make the place more interesting to increase preference. The uncertainty and coherence create the perfect structure and the information to make the perfect setting, yet too much regularity creates the places more boring. Complexity, naturalness, mystery, coherence, and spaciousness are the physical variables that were examined. Kaplan stated that variables do not recall the buildings yet are linked with the aesthetic preferences (Evans et al., 1982). Two aspects of the urban image are identified as objective dimensions including measurable qualities; size, shape, arrangements of the buildings, and subjective dimensions; the life of the city, architectural style, and genius loci measures that are perceived in cognition (Jacobs, 2011).

Studies on the structure of the image of people in the zone of proximal development led to the internalization of cognitive processes initially achieved in the social context and it is more impacted by social and cultural values than by physical perceptibility (Vygotsky, 1978). According to the notion of Inter-Representation Networks (IRN) the cognitive system linked to cognitive maps extends outside of the individual's mind and into the outer environment. Synergetic Inter Representation Networks (SIRN) can be considered to merge the psychological and spatial traditions of cognitive mapping studies. According to mainstream cognitive sciences, the psychological and geographic traditions were primarily focused on how the mind and brain process information (Portugali & Casakin, 2002; Siqi-Liu et al., 2022).

Considering the structure of the image theory of “Anchor point theory” by (Couclelis et al.,1987) the relation between cognition and urban elements provides the knowledge of how people spatially memorize spatial aspects and locate themselves inside a large space by using a small number of environmental points. Even while these researchers were able to outline the qualities of cognition schemata, they failed to link them to an investigation of how cities are perceived. Considering the anchor point hypothesis, the notion of multiple anchoring points, hierarchical structures, and localized relationships with the structure is considered.

An object that offers "external points of orientation, typically an immediately identifiable physical object in the urban landscape" is referred to as an urban landmark (Lynch, 1960). Landmarks are

fixed environmental features that are remembered for the special environment (Filomena & Verstegen, 2021; Filomena et al., 2020). For orientation, wayfinding, and communication, landmarks create the anchor points (Richter & Winter, 2014). Moreover, the uniqueness, prominence or salience features are dependent factors for the hierarchy of the landmark (Bernardini & Peeples, 2015). According to the Al- Shams and Badarulzaman (2014) the relationship between the people and the city structure in Kuala Lumpur further identify criteria relating to the landmark's factors; meaning, color, memorable, unique, legible, historic, design, and scale. The study distinguished that the city reflects the lifestyle of the city and diversified culture and values in the city's image.

According to Sorrows and Hirtle (1999 1990), landmarks are characterized according to the individual attributes of visual, structural, and cognitive salience. Rabul and Winter used the typology to construct a landmark salience model to analyze building facades (Raubal & Winter, 2002; Quesnot & Roche, 2015). The advanced visibility concept assumed that highly visible buildings would catch the attention of navigating by improving the visibility coverage and the orientation of the landmark (Winter, 2003). Parallelly, Kippel, and Winter improve the idea of structural salience. According to their findings, landmarks need to be in the same direction as the turning point and before the intersection (Klippel & Winter, 2005).

Without being legible, none of the urban features can be considered landmarks. When the physical and social qualities are strong then the urban identity gets stronger, and respondents recognize the landmarks due to their intrinsic value and the structural interaction rather than it is the orientation (Damayanti et al., 2020). Therefore, the recognition of landmarks is different from person to person in various circumstances.

Hierarchical representations are effective for cognitive spatial communication and reasoning. In addition, cognitive spatial representation demonstrates a hierarchical structure, from which one can deduce a hierarchy of landmarks that, for example, distinguishes between landmarks that indicate a city and those that represent a street intersection. Therefore, equal importance is given to each possible landmark. It is essential to consider additional factors, such as advanced visibility and quality, to identify a progression of landmark salience, or the frequency of choosing a particular building must be evaluated as a metric for the overall prominence of the item. The approach is then used to narrow the landmark selection for the subsequent level in the hierarchy using the frequency of selection as a measure of salience. The highest frequency counter is selected as the most important one and saved as an object of the subsequent higher level. The object count of each level reduces in this manner. When a single landmark, the most significant landmark for the area under investigation, is reached, the procedure is complete. Due to their distance or location, global landmarks are commonly used to communicate directional information in wayfinding applications. Most of the local landmarks are located at the main decision points and the on-route landmarks along the segments are better used for transferring the locational information.

Most of the studies relating to the image of the city use qualitative and quantitative methodologies. Lynch in his study describes how perceptions of the environment of the urban users are recorded in their minds as images and presents a technique that generates a cognitive map of the image in the mind. A cognitive map identifies the primary visual components of the urban area as they are seen by a city user (Lynch, 1960). According to Downs and Stea, cognitive

mapping involves gathering, organizing, storing, manipulating, and recalling data about the spatial environment, and cognition varies with age, use, and activity. Also, cognitive mapping is criticized for its technique because it limits the conveying of the subject. Therefore, rather than sketching, it is sufficient to recall the elements verbally (Silva, 2011).

'Mapping meaning in the city image: a case study of Kandy, Sri Lanka' by Silva (2011) argues that environmental cognition focuses on the visual and spatial attributes of an environment without taking into account meaning and meaning-related attributes. Snowball sampling was used for the study with more than 10 years of long-term residents to satisfy the familiarity of the area. A total of 49 people were used with 19 people who knew about the sacred meaning and 30 people who might not know about the sacred meaning of the Kandy. A free listing survey technique was used instead of mental mapping, and in-depth interviews examined the reason for the listing. Open-ended questions, a card sorting task, multiple-choice questionnaire was used to examine the sacred meaning in the Kandy context. The findings proved environmental meanings positively impact the imageability of the places (Silva, K. D. 2011).

According to Tian (2022), culture affects spatial memory, and spatial reference frameworks of the inhabitants and different cultural backgrounds have different degrees of outcomes. In order to conduct the study, eye tracking methods, designed mental rotations, spatial visualization, spatial orientation, and spatial correlation (SPSS) were used. A visual cognition study was used to reveal the cultural influence of the Chinese and Malaysian Chinese people. Of the 48 university students, 34 were from China, and 14 were from Malaysia. Results showed minimum differences between the cultural groups.

Lynch's urban perception studies were extended by Donal Appleyard and the study used both qualitative and quantitative methods for data collected for a study, especially on the building landmarks in a city in Venezuela. 75 persons from four residential areas of Venezuela were chosen under the quota sampling method based on age, gender, education level, familiarity, and travel mode. Recalled landmarks and building establishments were recorded, photographed, and scaled using the questionnaires.

The study specifically examines the correlation between the building form, intensity, and significance using the recalling frequencies such as map recall, verbal and trip recall. Appleyard identified that sketch maps and trip recalls are highly correlated with verbal recalls (Appleyard, 1976). The results showed building attributes such as symbolism, signs, and quality of the buildings have low significance values in recall.

Evans used verbal recall to measure the cognition of the residents of the urban structures in Orange, California. 72 of the aged 18 to 45 years who have lived for at least 1 year and 47 elderly people over 60, with at least 1 year resided are considered for the study. The uniqueness of the building function and use of singularity has less significance and symbolic significance, and the quality of the building is highly significant in recalling the built environment. Even though Evans focused on the generalizability of Appleyard's study on physical structural influence on the memory of the buildings, research findings were different due to cross-cultural and environmental differences (Evans et al., 1982).

The study "Mapping meaning in the city image: a case study of Kandy, Sri Lanka" by Silva (2011) emphasizes that the strong city image meaning and the city features strengthen the perceptions and cognition of the city image. Sacred meaning attributes are in the process of creating the perceptions. Preservation and development activities of the city are further focused on elevating the city's image by only focusing on the physical attributes, rather than the social values (Silva¸2011). The study "Spatial patterns and human behaviors: A study of urban public spaces in Kandy" by Botheju (2016) emphasized that human behavior is differentiated from geometric attributes and spatial patterns (Botheju, 2016 n.d.).

Another study based in Colombo, Sri Lanka that examined the public image of places, provided insights that in addition to the intensity of users and other factors that influenced the perceptions of Sri Lanka's city, the ground level of a built environment plays a critical role in determining its image along with high-rise development (Rathnasekara & Munasinghe,2021 2020).

A more recent study in Galle examined the relationship between imageability and legibility using cognitive and visibility analysis. The findings highlighted the positive relationship between imageability and legibility, imageability is more reliable on semantics than the legibility factors. But both visual and structural properties are important for imageability and legibility (Abeynayake et al., 2022).

Studies regarding the public image are more focused on the physical elements and physical perceptions of the structural city image. Appleyard (1969) concentrated on the physical building attributes, and Evans (1982) generalized Appleyard's study, including memories of the locations, etc. These studies comprise the relationship between the physical environment and environmental cognition. The people's perceptions and cognition trigger the imageability of the city. The idiosyncratic relevance of the objects is different from the experiences of the observers and personal significance.

Culture influences a person's spatial working memory, mental representations, and spatial cognitive strategy. Culture includes identity, language, education, lifestyle habits, etc. (Tian et al., 2022a). Different cultural backgrounds lead to varying degrees of spatial aptitude in individuals. According to Jacobs (2011), people's biological, cultural, and internal coherences significantly impact imageability. Even though scholars recognize that user characteristics influence shaping spatial ability, limited studies have been conducted on different user characteristics in evaluating the public image in urban planning and design. The study in Galle highlighted that historical significance evokes meaning to the users in imageability, yet the study did not examine the user characteristics (Abeynayake et al., 2022). In order to bridge the imageability concept and the user characteristics for urban planning, this study examined this limitation.

This study aims to generate awareness among planners and urban designers by examining the relationship between city users and the city structure, especially through evaluating the building attributes of the landmarks.

To achieve the objective, hypotheses were tested in order to determine whether there is a significant difference between the nationality (local or foreign), religion (Buddhist, Hindu,

Christian, Muslim), gender, age group, and stay period of the city users when recognizing the physical attributes of landmarks.

The literature review investigated many theories, concepts, and similar research regarding the city image. To evaluate landmarks according to Appleyard's study, thirteen attributes were used to evaluate their visual and structural salience. Planning for cities relies on generalizability, and this study also re-evaluated the original building attributes by Appleyard for Galle city (Appleyard, 1969). The study assessed the following research questions (RQ).

RQ 1. What are the specific elements (landmarks) present in the city that city users perceive in recalling?

RQ 2. Are there significant differences in memory recall among the inhabitants of a city environment based on their socio-demographic status?

The study examined the background of the individuals in the evaluation of the landmarks and structural characteristics of the landmarks in culturally diverse urban areas. Therefore, culturally diverse urban areas were selected for empirical studies. The study was carried out in Galle city considering the urban environment and cultural diversity of the area.

Galle is the largest city in Southern Province and one of the urbanized regions outside of the Colombo metropolitan region. Galle is world famous for the World Heritage site, the Galle fort. Galle city can be identified with 3 characteristics; Galle fort, the Modern city, and the Transition zone consisting of Dharmapala park and the international cricket stadium. The Galle city consists of old and modern architectural landmarks sprinkled in the Galle city as the evolution of the heritage value. However, according to the "Attributes of city brand of Galle" by Abeyweera and Kaluthanthri, the city itself failed in branding by untapping its uniqueness and tourism. In addition, Galle nurtures diverse ethnicities, religions, and cultures as a multi-cultural city. is home for several ethnic and religious groups. The population of Galle was about 93,118 (2020) and the total Sinhalese (70.5%), Sri Lankan Moor (28.2%), Tamil (1.3%), and others were residing within the city boundaries at the time the census records were taken. Within the fort area, the Muslim population is high with historical descent. As a tourist destination, foreign community participation can be also seen as a part of the Galle population. Therefore, it is a highly recognized cultural landscape within Sri Lanka.

As there is a wide variety of cultures, religions, and ethnicities in Galle, the way people see the city is different from one another. Due to the national interest of developing Galle city into a tourism-based city, Galle is an ideal study area to investigate the city image and the cultural, and ethnic variations of the city users. Accordingly, creating a distinctive sense of place for the city users is a subject of city planners.

An investigation of the future development of a city requires an understanding of how different social groups perceive building attributes (structural characteristics). To gain the attention of the city users and ensure the place of building attributes in the cognition of the city users, it is necessary to determine the reason for recognizing the attributes.

Methodology

Study design

The study follows qualitative and quantitative approaches to evaluate the Galle city image and the relationship between city landmarks and socio-demographic characteristics of the city users. The deductive research method tests the hypothesis and answers the research objective.

Ten (10) pilot subjects were interviewed through phone calls to identify the validity of the research applicability. Qualitative data was collected through verbal recalls of the mental image and the observations. Qualitative data complements the quantitative data analysis and the interpretations of the findings. Respondents were given a questionnaire survey sheet to answer, but most of the respondents were reluctant to fill it out by themselves. Therefore, interviewers filled the questionnaire by getting responses from the respondents.

The questionnaire consisted of 3 main questions as follows.

1. Information about the respondents' background such as nationality, religion, age, gender, familiarity with the city, and period of stay.
2. Listing 10 spatial elements you can think of in Galle city
3. Identifying the factors that played a role when it came to remembering those spatial elements.

Respondents were asked the question to recall the places, and buildings they remember the most in Galle city. Subsequently, the respondents were asked about the reason for recalling those buildings or places in terms of Appleyard's' building attributes: Form (Movement, Contour, Size, Shape, Surface, Quality, Signs), Visibility (Viewpoint intensity, Viewpoint significance, Immediacy) and Significance ((Intensity, Singularity, Symbolism) (Appleyard, 1969).

The respondents were asked to provide the possible 13 building attributes for focus on the building attributes. 5 minutes were spent on the verbal recall. The verbal recalling technique targets recalling the physical elements of the city such as buildings and places (Landmarks). Recalling frequency technique was used to identify the memory of the respondent to capture the cognition regarding the urban area (Rathnasekara & Munasinghe, 2021) since it more reliable than using cognitive sketch maps.

Once the recalled landmarks were collected, the information was analyzed in terms of recalling frequency. The number of times each landmark was mentioned was counted and sorted in decreasing order (RQ 1). Frequently recalled landmarks were assumed to be more salient than the least frequent landmarks (Abeynayake et al., 2022).

The landmark references were divided into six classes to develop the landmark hierarchy (Winter et al., 2008). (Keddem, 2021). The study aimed to identify the landmarks that exude a strong attachment to city users. Two (2) landmarks were selected from each hierarchical category (12 landmarks) to find the relationship between the selected landmarks, and demographic characteristics (Abeynayake et al., 2022; Raad Al Shams & Badarulzaman, 2014).

Statistical analysis

Collected data were analyzed using Chi-Square test in MS Excel to test the hypothesis of a relationship between the backgrounds of the inhabitants and the landmarks and perceived building attributes in Galle city. The study tested the hypothesis to determine whether there is a significant difference in the identification of landmarks and building attributes among the different user groups (Elias et al., 2009).

Sampling and sample size

Figure 1. Sample locations of the Galle city (2024). Generated using Google Earth.

It is difficult to determine the sampling size in Galle city (Figure 1) because it is an open area to all users. Therefore, sample size was determined based on the previous studies related to the research field. Lynch used a sample size of 100 respondents for each of the three cities while Appleyard used 75 respondents for 4 areas to evaluate the landmarks in Venezuela (Appleyard, 1969). Parallel to the Appleyard's study, Evan used 72 respondents between the ages 18 to 45 years and 42 respondents over-60 years of age in California (Evans et al., 1982). 49 respondents were used in the case of Kandy to identify the meaning of the city image in Kandy (Silva, K. D. 2011).

According to the study of Raad Al Shams & Badarulzaman, (2014), this study surveyed a group of 64 people using convenience sampling and then through quota samples to ensure a perfect count related to variables such as religion, age, gender, and period of stay. In addition, 10 foreign visitors were drawn from the Galle to make a total sample of 74 persons because the imageability level can be varied with the diverse categories. Data for this study were collected between the 27th of December to the 31st of December 2022, involving 74 respondents using structured questionnaires and surveys with informed consent. No personal identification information was gathered as part of the study. Participation was voluntary and the participants were informed that they were free to leave the study at any time with no consequence. 64 (86%) respondents were locals and 10 (14%) were tourists from Asia and Europe. Of the total respondents, 65% of the residents and commuters, and 35% were visitors. Among the total sample, 35 (47%) were Buddhist, 10 (14%) were Hindu, 14 (19%) were Catholic and 15 (20%) were Islamic. All the tourists were Catholics. Gender-wise, 28 (38%) were male, and 46 (62%) were female. Only 2 (2%) were below 15 years, 22 (30%) were 16- 25 age group, 37 (50%) of the respondents were 25- 50 age group and 13 (18%) were above 60 years of age.

Results

A total of 74 respondents identified 86 landmarks and out of 86 landmarks, 22 landmarks were identified by only one respondent, such landmarks were removed from the analysis to remove outliers. Out of the 74 respondents, 73 respondents recall the Galle Fort as a landmark. Fort was identified as a global landmark for orienting and locating places for both locals and tourists. As a heritage district, the Fort consists of numerous landmarks; thus, people recognized the Galle fort as a whole, not as an individual element. Therefore, Galle fort was removed from the landmark hierarchy in order of fair reference (Winter et al., 2008).

A maximum number of 55 references was received for a landmark, and the minimum number of references was 2. Accordingly, the references were divided into 6 classes for the landmark hierarchy ((55-2)/6). Table 1 shows the recall frequencies of the landmarks and the landmark hierarchy based on Abeynayake et al. (2022).

Table 1: Classification of the landmarks in the Galle city

No. of References	Hierarchy level	No. of Landmarks (n= 63)	List of Landmarks
47- 55	1	2	Bus stand, Railway station
38- 46	2	2	Dharmapala park, International cricket stadium
29 - 37	3	2	Police station, Municipal council
20- 28	4	3	Post office, Clock tower, Samanala ground
11- 19	5	8	District secretariat office, Siva kovil, Bank of Ceylon, Maritime museum, Roomassala temple, Light house, Dutch reformed church, St' Mary's church
2- 10	6	46	Al- Hussain mosque, Richard Pathirana library, Court square, Municipal fish market, Jungle beach, Samanala bridge, Highway bus stand, Fishery harbour, International Buddhist center, Southlands college, Keels supermarket, Karapitiya hospital,

Municipal fruit market, Fuel station, Mahamodara hospital, Galle prison, Market, Dutch hospital shopping complex, Alosyius college, Sacred Heart convent, Rich look, Prince cinema, Cargills food city, Pink arcade, AIDA gem shop, Sri Kadiraweliswami kovil, Football ground, Japan peace temple, KFC, Department of registration of persons, Sangamitta vidyalaya, Asiri hospital, Army camp, Laksala, P & S, Navy camp, Co-operate Hospital, Dholosmahe clothing shop, Pedestrian bridge, Vidyaloka college, Black bridge, Richmond college, Rippon college, NIBM, Unawatuna devol devalaya, Kachchuwatta temple

Figure 2. Landmark saliency level in Galle city. (2024) Generated using Google Earth.

Results from the recall frequencies reflect that most recalled landmarks are located within the core area of the city. According to Figure 2, most of the landmarks from the hierarchy 1, 2, and 3 are located within the city core area. Hierarchy 4 onwards is located a little away from the core area of the city. Parallelly railway station 74% (55 out of 74) and Bus stand 72% (53 out of 74) is mainly recalled by the people as both places are located close to each other and connected with the pedestrian bridge. Respectively, Dharamapala park (42 out of 74) and international cricket stadium (38 out of 74) were recalled by 55% and 51% of the total respondents. Likewise, recall frequencies gradually decrease with the distance including that for Police stations, Municipal Council, Post Office, etc.

As an example, the Railway station and the bus stand are high-user intensity, higher movements, viewpoint intensity, and use singularity buildings that are low-rise buildings. Dharmapala Park is

an open area that has higher user intensity, unique contours, and movements. In addition, the international cricket stadium is an open area that has higher recall frequencies due to viewpoint singularity and the use singularity with the higher user intensity. These two open spaces are the transitional zone that creates a positive separation between the Galle busy city core and the heritage Galle fort area. Regardless of physical form, these city elements attract higher visibility and higher semantic salience in cognition for better recall. **Figure 2** can identify recalled landmarks as a combination of the transportation nodes, landscapes, open areas, and buildings, which are unique with the user intensity, user singularity, movements of the city users, and viewpoint intensity of the elements.

Accordingly, the size of buildings (high rises) is not significantly important for recognition, yet it is less important than the human-scaled buildings (Rathnasekara & Munasinghe, 2021).

Figure 3. Locations of the selected landmarks (2024) Generated using Google Earth. Elevations were generated manually, considering the actual number of floors of the building.

Six hypotheses are tested to determine the differences in recognizing the landmarks by the different user variables (nationality, religion, age, gender, familiarity with the city, and period of stay). Four of the hypotheses were accepted. A similar study done in Hanover, Germany used the chi- square test to determine the user variables in recognizing the landmarks in terms of wayfinding (Elias et al., 2009).

The following shows the hypothesis tested for the Religion factor; the rest of the five hypotheses are tested in the same order.

Null hypothesis – H_0: There is no significant association between city users' Religion for recognizing the city landmarks (The landmarks evaluation is independent of city users' religion)

Alternative hypothesis – H_1: There is a significant association between city users' Religion for recognizing the city landmarks (The landmarks evaluation is dependent on the religion)

Table 2: Cross tabulation of the landmarks and the recall frequencies of the different religion groups

Observed						
		Religion (Frequency)				
Landmark Hierarchy	**Landmarks**	**Sum of Buddhists**	**Sum of Hindus**	**Sum of Christians**	**Sum of Muslims**	**Total**
47 -55	Bus stand	35	6	4	10	**55**
	Railway station	35	5	3	10	**53**
38 -46	Dharmapala park	28	2	8	4	**42**
	International cricket stadium	28	3	5	2	**38**
29 -37	Police station	26	2	2	2	**32**
	Municipal council	24	0	2	3	**29**
20 -28	Post office	23	1	1	3	**28**
	Clock tower	13	0	9	2	**24**
11 -19	District secretariat office	16	0	0	1	**17**
	Siva kovil	9	6	0	2	**17**
2 -10	Al- Hussain mosque	2	0	0	7	**9**
	Richard Pathirana library	8	0	1	0	**9**
	Total	**247**	**25**	**35**	**46**	**353**

Actual and expected recall frequencies produced for each landmark (in rows) and each religion (in columns) were counted (**Tables 3** and **4)**.

Table 3: Cross tabulation of the landmarks and the recall frequencies of the different religion groups (expected)

Expected = (row total*column total)/grand total						
		Religion (Frequency)				
Landmark Hierarchy	**Landmarks**	**Sum of Buddhists**	**Sum of Hindus**	**Sum of Christians**	**Sum of Muslims**	**Row total**
47 -55	Bus stand	38.48	3.90	5.45	7.17	**55**
	Railway station	37.08	3.75	5.25	6.91	**53**

38 -46	Dharmapala park	29.39	2.97	4.16	5.47	**42**
	International Cricket Stadium	26.59	2.69	3.77	4.95	**38**
29 -37	Police station	22.39	2.27	3.17	4.17	**32**
	Municipal Council	20.29	2.05	2.88	3.78	**29**
20 -28	Post office	19.59	1.98	2.78	3.65	**28**
	Clock Tower	16.79	1.70	2.38	3.13	**24**
11 -19	District Secretariat Office	11.90	1.20	1.69	2.22	**17**
	Siva Kovil	11.90	1.20	1.69	2.22	**17**
2 -10	Al- Hussain Mosque	6.30	0.64	0.89	1.17	**9**
	Richard Pathirana Library	6.30	0.64	0.89	1.17	**9**
	Column Total	**247**	**25**	**35**	**46**	**353**

Table 4, shows the chi-square statistics which determines whether the differences between the observed and expected values are statistically significantly different.

Table 4: Chi-square distribution of the landmarks and the recall frequencies of the different religion groups

Chi-square statistic = (Observed-Expected) ^2 / Expected					
		Religion (Frequency)			
Landmark hierarchy	**Landmarks**	**Sum of Buddhists**	**Sum of Hindus**	**Sum of Christians**	**Sum of Muslims**
47 -55	Bus stand	0.32	1.14	0.39	1.12
	Railway station	0.12	0.41	0.97	1.39
38 -46	Dharmapala park	0.07	0.32	3.53	0.40
	International cricket stadium	0.07	0.04	0.40	1.76
29 -37	Police station	0.58	0.03	0.43	1.13
	Municipal council	0.68	2.05	0.27	0.16
20 -28	Post office	0.59	0.49	1.14	0.12
	Clock tower	0.86	1.70	18.42	0.41
11 -19	District secretariat office	1.42	1.20	1.69	0.67
	Siva kovil	0.70	19.11	1.69	0.02
2 -10	Al- Hussain mosque	2.93	0.64	0.89	28.95
	Richard Pathirana library	0.46	0.64	0.01	1.17

The Chi-square value of 103.67 is much larger than the critical value of 43.77, P value for the chi-square statistic is 0.000 which is smaller than the alpha level of 0.05. Therefore, the Null hypothesis (H_0) was rejected, and the Alternative hypothesis (H_1) was accepted.
There is a significant association at a 95% significance level between city users' religion in the recognition of city landmarks ($x^2 = 103.67$, df =33, p = 0.000).

Same as city users' religion other hypotheses were tested using the Chi-square analysis and the results are mentioned below.

There is a significant association at a 95% significance level between city users' nationality (x^2 = 39.44, df =11, p = 0.000) city users' periods of stay (x^2 = 42.79, df = 22, p = 0.004), city users' age (x^2 = 86.48, df =33, p = 0.000) in recognizing the city's landmarks. Further, the study identified there is no significant association in recognizing the city landmarks based on the city users' gender differences (x^2 = 19.28, df =11, p = 0.056) and the city users' familiarity (x^2 = 31.12, df =22, p = 0.093) in recognizing the city's landmarks.

Accordingly, the study found that there is a significant association between the recognition of landmarks by nationality, religion, age, and period of stay. There was no association in the recognition of landmarks by gender and familiarity.

Discussion

As mentioned in the literature many scholars stated that imageability relies on people's personalization characteristics. And it varies with the different users' variables.

The above findings confirm that by testing the hypothesis that there is a significant difference between recognizing the landmarks by different user groups based on nationality, religion, age, and stay period and there is no significant difference in recognition of landmarks by gender and familiarity.

A similar study in Hanover showed significant differences between familiarity, gender, and, diverse age groups in selecting landmarks for wayfinding (Elias et al., 2009). A study in Kuala Lumpur identified there were significant differences in public evaluation of landmarks based on nationality, and ethnicity and no association of gender, age group, and educational level of the respondents (Raad Al Shams & Badarulzaman, 2014). A study in China examined the cultural differences in evaluating the degree of spatial ability, minimal differences were identified between the Chinese and Malaysian Chinese people (Tian et al., 2022a). The reliable studies reconfirm that findings differentiate according to the different geographic locations and user variables.

By adhering to the differences in the users' characteristics, in terms of the impact of the building attributes in recalling the landmarks, most of the foreign, younger age groups, visitors, and unfamiliar user groups predominantly evaluate the public image through the physical building form (shape, quality, size, surface, signs, contours, movements). Due to the unfamiliarity with the city, the immediate experience of the city will be evaluated by the physical form of the elements. Here, the findings verify the work of Appleyard (1969), where he describes, "… incongruencies may be especially troublesome to those who depend more on the environment, more probably newcomers, migrants, youngsters, visitors……" (Appleyard, 1969).

Highly cognitive spatial elements are in the city core area, in a very high viewpoint location. Considering the recalled answers from the audience, foreign groups, identified highly legible landmarks and global landmarks, yet didn't recognize the local landmarks. However, local audiences recall both local and global landmarks due to user perceptions. By observing the landmarks hierarchy, the recall frequencies decrease when the recall landmark is farther away from the city core area.

As the landmark consists of three factors, form, structure, and semantic salience, this study specifically studied only the form and the structural saliency of the Galle city. Therefore, the semantic aspects of the environment are less considered in this study. The sample taken for the study is only 74, which causes the possibility of different results with a greater sample of city dwellers. There are many other user variables other than nationality, religion, age, gender, familiarity, and period of stay, like, education, mode of travel etc. However, due to the time limitations, those variables were not accounted for in this study.

The study was analysed within a quantitative and deductive framework to test the statistical relationships between the user characteristics and landmark recognition, yet the nature of the research problem suggests that the qualitative, inductive method would have been more suitable since the study focused on finding the meaning and perceptions in users' mental representation of the city. Therefore, the qualitative method, like interviews and narrative analysis, could have provided many consistent insights. Therefore, the future emphasis on the inductive qualitative method will generate the theory from lived experiences and cultural dimensions, providing more depth in social cognition. And this methodological shift may further help to uncover the deeper relationships between social identity a d perceived urban image in more holistic understanding in multicultural city contexts.

The observation concludes that the highly visible locations are reasons to be high in use intensity, and movements demand more visible attributes to be memorable within the core city area. Frequently recalled landmarks are positioned on the axis of the main road, which creates immediacy and viewpoint significance. It composes the scales of the viewpoint intensity (Appleyard, 1969). The relation between the visibility and the imageability concepts is highly correlated with the visual, structural, and semantic saliency of the landmarks (Abeynayake et al., 2022).

Conclusions

The study commenced by studying the impact of socio-demographic characteristics of the city users when recognizing the spatial elements. The literature revealed the relation between environmental cognition and city image studies and found the gap in the limited literature in investigating how user characteristics differentiate in recognizing the city image and physical attributes.

The study revealed there are differences in recognizing the landmarks based on nationality, religion, period of stay, and age. In spite of this, the different perceptions of landmarks by people from various backgrounds may enrich their experience of the city through their interactions with its structure and spaces.

Conflict of interest statement

The authors declare that they have no conflict of interest.

References

Abeynayake, T., Meetiyagoda, L., Kankanamge, N., & Mahanama, P. K. S. (2022). Imageability and Legibility: Cognitive analysis visibility assessment in Galle heritage city. *Journal of Architecture and Urbanism*, 46(2), 126–136.

Abeyweera, M.A.N.S. and Kaluthanthri, P.C. (2018) Attributes of City Brand of Galle City, Sri Lanka, *International Conference on Real Estate Management and Valuation (ICREMV)* 2018, 100-111.

Appleyard, D. (1969). Why Buildings Are Known. *Environment and Behavior*, *1*(2), 131–156. https://doi.org/10.1177/001391656900100202

Appleyard, D. (1979). The Environment as a Social Symbol: Within a Theory of Environmental Action and Perception. Journal of the American Planning Association, 45(2), 143–153. https://doi.org/10.1080/01944367908976952

Askarizad, R., & He, J. (2022). Perception of Spatial Legibility and Its Association with Human Mobility Patterns: An Empirical Assessment of the Historical Districts in Rasht, Iran. *International Journal of Environmental Research and Public Health*, *19*(22), 15258. https://doi.org/10.3390/ijerph192215258

Bernardini, W., & Peeples, M. A. (2015). Sight Communities: The Social Significance of Shared Visual Landmarks. *American Antiquity*, *80*(2), 215–235. https://doi.org/10.7183/0002-7316.80.2.215

Botheju, P. (2016). Spatial Patterns and Human Behaviours: A study of Urban Public Spaces in Kandy. (N. Jayasundara, Ed.; Proceedings of the International Conference on 'Cities, People and Places'-ICCPP-2016 October 30th –31st, 2016, Colombo, Sri Lanka).

Constantinides, M., Joglekar, S., Šćepanović, S., & Quercia, D. (2021). Imagine a Walkable City: Physical activity and urban imageability across 19 major cities. EPJ Data Science, 10(1). https://doi.org/10.1140/epjds/s13688-021-00313-7

Couclelis, H., Golledge, R. G., Gale, N., & Tobler, W. (1987). Exploring the anchor-point hypothesis of spatial cognition. *Journal of Environmental Psychology*, *7*(2), 99–122. https://doi.org/10.1016/s0272-4944(87)80020-8

Damayanti, R., Tampubolon, A. C., & Kusumo, C. (2020). The evaluation of city landmarks through the study of place attachment in Surabaya, Indonesia. IOP Conference Series: Earth and Environmental Science, 490(1), 012014. https://doi.org/10.1088/1755-1315/490/1/012014

Damayanti, Rully and Kossak, Florian (2016) *Extending Kevin Lynch's concept of imageability in third space reading; case study of Kampungs, Surabaya–Indonesia. A/Z ITU Journal of Faculty of Architecture,* 13 (1), 57-67. ISSN 13028324

Elias, B., Paelke, V., & Chaouali, M. (2009). Evaluation of user variables in topographic feature recall for the informed selection of personalized landmarks. In G. Gartner & K. Rehrl (Eds.), Location Based Services and TeleCartography II (pp. 121–136). Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-87393-8

Evans, G. W., Smith, C., & Pezdek, K. (1982). Cognitive Maps and Urban Form. Journal of the American Planning Association, 48(2), 232–244. https://doi.org/10.1080/01944368208976543

Filomena, G., & Verstegen, J. A. (2021). Modelling the effect of landmarks on pedestrian dynamics in urban environments. Computers, Environment and Urban Systems, 86, 101573. https://doi.org/10.1016/j.compenvurbsys.2020.101573

Filomena, G., Manley, E., & Verstegen, J. A. (2020). Perception of urban subdivisions in pedestrian movement simulation. PLOS ONE, 15(12), e0244099. https://doi.org/10.1371/journal.pone.0244099

Jacobs, M. (2011). Psychology of the visual landscape. Research in Urbanism Series, 2(1), 41–54. https://doi.org/10.7480/rius.2.206

Kaplan, S. (1979). Perception and landscape: Conceptions and misconceptions. In G. H. Elsner & R. C. Smardon (Eds.), Proceedings of the Our National Landscape: A conference on applied techniques for analysis and management of the visual resource, 241–248. https://books.google.com/books?id=k7aj4pEi9zMC

Klippel, A., & Winter, S. (2005). Structural salience of landmarks for route directions. In A. G. Cohn & D. M. Mark (Eds.), Spatial information theory: COSIT 2005, 347–362. Springer. https://doi.org/10.1007/11556114_22

Lynch, K. (1960). The image of the city. MIT Press.

Moore, G. T. (1979). Knowing about Environmental Knowing. Environment and Behavior, 11(1), 33–70. https://doi.org/10.1177/0013916579111002

Nasar, J. L. (1990). The Evaluative Image of the City. Journal of the American Planning Association, 56(1), 41–53. https://doi.org/10.1080/01944369008975742

Nasar, J. L. (1994). Urban Design Aesthetics: The Evaluative Qualities of Building Exteriors. Environment and Behavior, 26(3), 377–401. https://doi.org/10.1177/001391659402600305

Portugali, J., & Casakin, H. (2002). SIRN (synergetic inter-representation networks): An approach to design. In D. Durling & J. Shackleton (Eds.), Common ground: Proceedings of the Design Research Society International Conference 2002, 5-7. https://dl.designresearchsociety.org/drs-conference-papers/drs2002/researchpapers/65

Quesnot, T., & Roche, S. (2015). Quantifying the significance of semantic landmarks in familiar and unfamiliar environments. In S. Fabrikant, M. Raubal, M. Bertolotto, C. Davies, S. Freundschuh, & S. Bell (Eds.), Spatial information theory: COSIT 2015 (Lecture Notes in Computer Science, Vol. 9368). Springer. https://doi.org/10.1007/978-3-319-23374-1_22

Raad Al Shams, A., & Badarulzaman, N. (2014). Evaluating the City Image: A Focus on Landmarks of Kuala Lumpur, Malaysia. Asian Social Science, 10(4), 241–254. https://doi.org/10.5539/ass.v10n4p241

Rathnasekara, S. N., & Munasinghe, J. N. (2021). Sustaining the Image of the City: What Matters More? An Investigation in the City of Colombo. FARU Journal, 8(1), 24. https://doi.org/10.4038/faruj.v8i1.60

Raubal, M., & Winter, S. (2002). Enriching Wayfinding Instructions with Local Landmarks. Geographic Information Science GIScience 2002, 2478, 243–259. https://doi.org/10.1007/3-540-45799-2_17

Richter, K.F., & Winter, S. (2014). Landmarks: GI science for intelligent services. Springer. https://doi.org/10.1007/978-3-319-05732-3

Silva, K. D. (2011). Mapping Meaning in the City Image: A case study of Kandy, Sri Lanka. Journal of Architectural and Planning Research, 229-251.

Siqi-Liu, A., Egner, T., & Woldorff, M. G. (2022). Neural Dynamics of Context-sensitive Adjustments in Cognitive Flexibility. Journal of Cognitive Neuroscience, 34(3), 480–494. https://doi.org/10.1162/jocn_a_01813

Sorrows, M. E., & Hirtle, S. C. (1999). The Nature of Landmarks for Real and Electronic Spaces. In C. Freksa & D. M. Mark (Eds.), Spatial Information Theory. Cognitive and Computational

Foundations of Geographic Information Science (pp. 37–50). https://doi.org/10.1007/3-540-48384-5_3

Szczepańska, M., Wilkaniec, A., Łabędzka, D., & Micińska, J. (2013). Non visual perception of landscape- Use of hearing and other senses in the perception of selected spaces in the city of Poznan. Teka Komisji Architektury, Urbanistyki I Studiów Krajobrazowych, 9(2), 68–79. https://doi.org/10.35784/teka.2535

Tian, Y., Yang, T., & Dong, W. (2022). Does Culture Shape Our Spatial Ability? An Investigation Based on Eye Tracking. ISPRS International Journal of Geo-Information, 11(11), 578. https://doi.org/10.3390/ijgi11110578

Vygotsky, L. S. (1978). Mind in Society: Development of Higher Psychological Processes. Mind in Society: Development of Higher Psychological Processes, 1(1). https://doi.org/10.2307/j.ctvjf9vz4

Winter, S. (2003). Route Adaptive Selection of Salient Features. Spatial Information Theory. Foundations of Geographic Information Science, 349–361. https://doi.org/10.1007/978-3-540-39923-0_23

Winter, S., Tomko, M., Elias, B., & Sester, M. (2008). Landmark hierarchies in context. Environment and Planning B: Planning and Design, 35(3). https://doi.org/10.1068/b33106