The Role of Spatial Configuration on Spatial Cognition: Insights from the Historic Grid City of Kandy, Sri Lanka

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Abstract

Sri Lanka, a country rich in cultural heritage, is undergoing significant infrastructure development in recent years. This development creates a conflict between modernization and the preservation of historic city character, impacting the spatial configurations that play a crucial role in spatial cognition for its users.

This study employed a mixed-method approach to assess subjective perceptions using Kevin Lynch's theories through structured interviews and questionnaires, where respondents drew cognitive maps. It also utilized objective measures of street configuration via the space syntax method by Bill Hillier and DepthmapX software.

Findings revealed that most perceived landmarks are linked to their historical significance, function, and physical features like height, color, and mass. Perceived paths were influenced by personal experience, buildings along the path, and physical features such as building height, façade character, and path orientation. The study concludes by providing insights for future urban planning interventions to preserve historic city identities through a deeper understanding of city imagery, element interrelation, and city arrangement.

Keywords: Spatial Cognition, Cognitive mapping, Spatial Configuration, Space Syntax theory, Historic city

Introduction

Due to the rapid urban developments in historic cities, the essential infrastructure developments tend to transform the spatial structure and spatial image, including its physical structure. Kandy as a UNESCO world heritage city in Sri Lanka, is recognized for its cultural and historic significance faces the challenge of an evolving development pressure compromising the preservation of its city image. The transformation in the physical structure not only impacts the visual appearance but also the public image and collective memory.

In this context, this study investigates how the configuration of the city of Kandy impacts resident and visitor cognition. This inquiry is critical as this city has urban design

interventions to preserve the city and rebuild the character of its façades but does not focus on reviving the image of the city. The study further emphasizes the gap in the literature as most studies identify the major elements in a city but does not identify the relation between each of these elements which affects human cognition and perceived experience. Hence the study provides evidence of how the city configuration affects the city identity and of its applications in cognitive studies in the urban planning field. The study is grounded in the theories of environment and behavior studies related to urban areas.

Given that the research methods and tools have been predominantly utilized in fields beyond architecture evaluating both psychological aspects of people and the linear aspects of layouts, the study must distill architectural insights while analyzing data collected from residents and visitors (including foreign tourists, local tourists, employees working in the city, or those commuting through it) using the computational software DepthmapX, based on certain assumptions.

The aim of the research is to ascertain the impact of city configuration on resident and visitor cognition. Its objectives are:

1. To analyze the impact of city configuration on resident and visitor cognition.
2. To identify key elements that build the imageability of the city of Kandy.
3. To provide factors to be considered in urban planning initiatives of preserving the historic city of Kandy.

Theoretical Framework

A city is a collection of spaces or buildings to which individuals add meanings on their own. Therefore, a city can be identified as not only a physical space but also as a set of mental images created and shared by people. Rossi (1966) elaborates that a city can be described as a collection of memories of people associated with objects and places. According to Kim (1999) the perception of human mind can be identified as an act of understanding the environment through mind and sense with observations while cognition can is the knowledge of information of the environment in the memory. Therefore, the definition of spatial cognition of a city can be developed by a set of perceptions and spatial knowledge acquired through experience of a city, based on the perspective of Rossi (1966).

The concepts of Lynch (1960) further highlight the term spatial cognition, in his later work additionally providing the significance of relation between the urban elements which plays a major role when creating spatial cognition. Therefore, the concept of spatial cognition can be described as,

1. Physical elements (as mentioned in the previous section- paths, edges, districts, nodes, and landmarks)
2. Relation between elements (the knowledge about the certain elements in a city related to the other elements in a city).

Kim (1999) states that the spatial knowledge acquired through experience can be described as: the ability to identify landmarks, the route linking landmarks, and the abstract idea on a spatial structure. Therefore, in agreement to the point above, it can be understood that the elements in cities should not specifically be the largest, prominent elements, instead located in more visible and identifiable spots in an urban structure. Moreover, the elements could be associated with certain perceived knowledge about history or certain events as these elements such as landmarks could not exist solely in the mental image, but rather as a group of elements with a certain pattern or arrangement.

The concept of legibility was highlighted by Lynch (1960) elaborating the concept of spatial knowledge as the ease of recognizing and ability to organize the elements in a city as a coherent pattern, which allows the observer to draw a more accurate and complete cognitive map (Long, Y. et.al., 2007). He also emphasizes that people in cities with regular and structured grid patterns (linear, parallel, perpendicular…etc.), have been able to draw more accurate and complete map of the city.

Therefore, the paper explores three major concepts relating to this idea focusing on the definition of a city, spatial structure and spatial cognition, which are inter-relating concepts essential for understanding how people perceive and interact with urban spaces and elements.

Literature Review

Many have examined this issue. Rossi (1966) characterizes a city as a vast, man-made entity distinguished by its history, identity, and form - three essential aspects for understanding a city's character. He elucidates that history serves as the city's skeleton, marking the passage of time and events within it. Rossi further posits that history can transform into collective memory. Reinforcing this concept, a city embodies the collective memories of its inhabitants, linked to objects and places. Therefore, cities are dynamic structures, evolving over time and reflecting historical events through their physical forms. Accordingly, Lynch (1960) discusses that the physical form of a city can be categorized as follows,

1. **Paths:** Channels which the observer potentially moves along; could be streets, walkways, canals, railroads…etc. Paths can be related as a predominant element in the city as all the other elements in the city are arranged along or related to the paths.
2. **Edges:** Linear elements which potentially couldn't be considered to move along but a boundary to break the continuity in the city such as seashores, railroad edges, edges of the developments or walls…etc.
3. **Districts:** Zones/ sections in the city where an observer could recognize some common characters, enter mentally, and be considered as "inside of".
4. **Nodes:** Strategic focal points in the city where an observer can enter, primarily a junction or a crossing.
5. **Landmarks:** A point of reference is a dominant physical object which can be observed externally. Landmarks can be identified as the most dominant element type in the city, which symbolizes certain meanings.

Beyond history itself, cities are renowned for its identity which is shaped by its history and form. Instead, Lefebvre (1974) conceptualizes a city as a social space reflecting the social and cultural significance taken place in a context. Therefore, sense of identity could be narrowed into concepts of sense of place which could be recognized by its character. Steele (1981) further states that the experience people gain through a place can be defined as the identity of a certain place, which can be varied with individual memories, ideas, and conception about the place. Cities are not neutral and static environments, but dynamic environments shaped by historic legacies taken place in the context and cultural practices of inhabitants. Moreover, spatial cognition of individuals can be shaped by personal experiences and key factors such as familiarity, travel mode, home location, associativity, and socio-economic characteristics (Long, Y. et.al., 2007).

Human perception and cognition involve creating mental images of places, which in turn influence spatial behavior. This study focuses on spatial cognition by examining two distinct groups: city residents with familiarity and knowledge of the city's layout, and visitors with limited knowledge and unfamiliarity with the city's structure.

In addition to that Golledge (1987) explains that cognitive maps can be identified as one's mental representation of the spatial information in a particular city. The process of creating cognitive maps reflects the knowledge about the environment, also known as spatial knowledge, which includes both physical and non-physical components in the environment. Haq (2001) states that the cognitive maps are useful to locate or orient oneself, to find their destinations. The overall mental images of the built environment can be partial, covering only certain areas, simplified by omitting finer details, unique based on personal experiences, and sometimes distorted by specific information regarding the arrangement of elements. Building on this idea, the concept of imageability refers to the visual quality of the surrounding environment, including the clarity and recognition of its elements and arrangements. This study aims to explore the connection between cognition and spatial arrangement in a city.

Accordingly, Ching (2007) states the elements of a space can be arranged as follows,

1. **Centralized Organization:** A stable and more concentrated composition which highlights the central space.
2. **Linear Organization:** A series of spaces directly related to another and placed along a specific linear space.
3. **Radial Organization:** A combination of both linear and centralized organization, including a centralized central space and linear extending outwards.
4. **Clustered Organization:** A composition of different spaces relating to a certain pattern or visual order. Symmetry along an axis and hierarchy can be identified as the governing rules in the organized spaces.
5. **Grid Organization:** The organization of each element is related to a two-dimensional grid pattern, which is a set of parallel lines arranged perpendicularly. Regularity and continuity can be identified as the common factor.

Extending the given description, Kim (1999) describes the term configuration as how each of the elements is organized and related to the other elements, respecting the overall arrangement of the space. To assess the configuration, or to find the patterns that interact between people and their environment, the syntactic approach has been introduced. According to Kim (1999) the concept of space syntax is not only an effective tool for exploring the interactions between people and their environment but also a method to assess the spatial configuration as a collection of local elements which can be identified as a network. Hillier (1996) argued that the configuration is a dominant force which is impacting on the patterns of land use, blocks of mixed uses and density of buildings throughout the evolution and shaping of historic cities. Therefore, it could be concluded that spatial configuration determines the overall distribution of the movement in a city, hence the cognitive maps also developed through moving along a city.

Moreover, Kim (1999) discussed that the properties of convexity, lines of sight and changes of direction are believed to be the most fundamental properties in the analysis of spatial configuration, that is generally known as ‘Space Syntax’. Hillier (1996) further explains that the way people observe the built environment can be represented in spatial configuration in two different units,

1. Convex shape: which can be defined as a two-dimensional space where all the points can perceive at once as an entire layout,
2. Axial line: represents the furthest point of view when moving through the city, while the intersections preview the nodes in the structure.

Therefore, the axial maps and convex maps can be identified as the basic maps which could be used to assess human movement and preview the spatial configuration, while Hillier (1996) has further introduced a few other measures of configuration, where the axial lines can be quantified and assess certain other measures, such as:

1. **Connectivity:** A syntactic measure to assess the relationship between two immediate spaces. Therefore, it can be concluded as a quantitative measure to assess how different spaces are connected and how well people move between spaces.
2. **Integration:** A syntactic measure to quantify how accessible the space or the segment of the street is. Therefore, the term integration can be concluded as a quantitative measure to assess the accessibility of certain spaces in a place. Further, the method could be used to determine the best positioning of built elements in a certain area. Further the space syntax method provides the integration map with color graded axial map representing the degree of integration for the selected area.
3. **Visibility:** A syntactic measure defined as the set of points in the particular built environment that can be seen from the selected point. This method can be used in spaces where well-defined boundaries of the built environment can be identified, as in urban environments and the interior of buildings.

(Hillier 1996; Long, Y.et. al, 2007)

To conclude, paths with higher integration and connectivity enhance observers’ ability to accurately perceive elements in an urban structure, which are represented in cognitive maps

through a hierarchical structure of spatial image memorability (Long et al., 2007). Based on the literature review, spatial configuration is crucial for the cognition of the built environment. Key points include:

1. Cognitive maps represent urban elements hierarchically in terms of identity, structure, and meaning, with variations between residents and visitors due to differing spatial knowledge.
2. The space syntax method can quantitatively assess spatial configuration in urban environments, while cognitive maps provide a qualitative assessment of spatial cognition.

The following figure illustrates the study's conceptual framework, comparing the insights from the literature review and the methods used in the study.

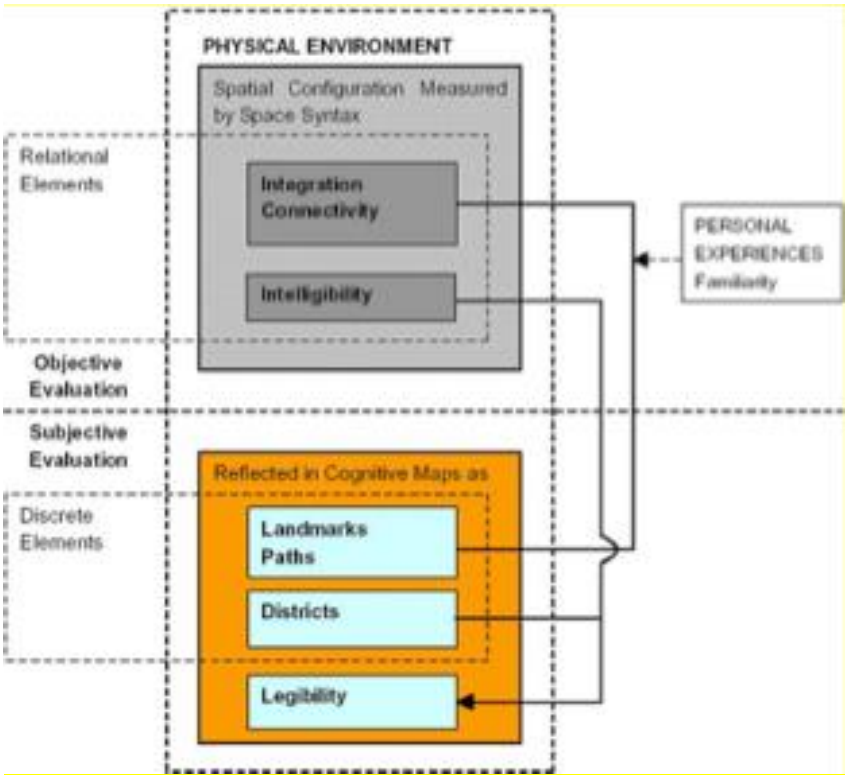


Fig. 1: Conceptual framework for the study
Source: Long, Y. et.al., 2007

Previous studies indicate that a city's public image is shaped by its physical structure, including major landmarks, paths, edges, districts, nodes, and the spatial arrangement of elements. Additionally, recent research confirms that spatial cognition is influenced by the spatial configuration of an environment. However, there remains a gap in understanding the dominant factors that identify recognizable elements within a context, highlighting the novelty of this research.

Research Methods

The research methodology includes both qualitative and quantitative methods to collect data. The mixed-mode research approach ensures the accuracy of the findings as well as prove the theoretical approaches in practical and real-world contexts. Using qualitative methods such as Sketch mapping, questionnaire and quantitative method as the space syntax mapping. The categorization of primary data collection tools are as shown below:

Table 1: Methods used for the data collection
Source: Author

Objective	Data	Research Tool	Outcome
How people memorize the elements of the city	Imageability	Sketch mapping (On a paper indicating the axial streets)	Identifying the most memorable elements in the city
How people perceive the elements and the arrangement of the city	On-site experience on the sequence of the journey	Interview Survey Questionnaire	Identifying how the arrangements impact the perception in the city

Data collection Method: Model Questionnaire requesting a sketch map
The initial pilot survey conducted to identify whether the collected data from the questionnaire and sketch maps support the study. Following are the questions by Lynch (1960) asking the respondents to draw a sketch map as remembered on a blank paper.

1. "What symbolizes the city for you? How would you describe the city in a physical sense?"
2. "Make a quick map of the city. (a rapid description of the city to a stranger, covering all the main features) – The sequence of the drawing should be noted"
3. "Give the directions for the common route that you normally take going through the city. The sequence of things you would experience, the clues that a stranger need to identify including the physical pictures of things."
4. "Any emotions about various parts of your city? Are there parts of the city where you feel uncertain of your location?"
5. "What elements of the city do you think are most distinctive? (Might be different in scale and the easiest to identify and remember)"
6. "Would you show the map indicating above mentioned places?"

There, some of the drawbacks were identified in the above method,

- Some people found it hard to visualize the city and draw on a blank paper (different drawing abilities)
- Some questions seem to repeat similar kinds of answers
- Residents have elaborately described their experiences rather than identifying and locating the elements and paths
- Some of the questions did not provide particular answers to the study area.

Therefore, the initial questionnaire was altered and simplified for people to understand, provide a base map with the street network to draw the sketch map and some of the main streets will be pointed out for easy identification.

Close-ended:

1. What is the relationship between you and the city? Resident/ Visitor

Open-ended:

2. What are the built elements that symbolize the city?
3. What are the elements you used as wayfinding?
4. What are the emotions and experiences you feel in certain places in the city?
5. What are the most distinctive features of the city according to you?

Sketch on the base street map:

6. Can you locate the above-mentioned elements in a map to orient oneself in the city?

Survey interviews were conducted with 18 random respondents: 9 were city residents who visit for necessary activities, and 9 were visitors who had been to the city once or twice, including 3 foreign visitors and 6 local visitors for recreational purposes. The interviews took place on the streets of grid city, Kandy, between December 20th and 23rd, 2023, coinciding with the holiday season when the city sees increased footfall. Respondents answered questions about their city experience, and their responses were noted. They were given a simple, unlabeled street map and asked to mark their journey through the city, highlighting elements they remembered as significant. Following table demonstrates the main methods used for data analysis:

Table 2: Methods used for the data analysis
Source: Author

Objective	Data	Analysing Tool	Outcome
How people memorize the elements of the city	Visual analysis of the image, identity	Find the accuracy and frequency of each element on cognitive maps and score	Identifying the most memorable elements in the city- a combined sketch map
How the street network is arranged, and elements are placed	Level of integration, Connectivity and Visibility	Space Syntax maps	Evaluating the syntactic properties of the street network

Analyzing method for Spatial cognition

Method 1.1: Composite sketch map and verbal interviews (Lynch, 1960)

The frequency of each element appearing in all the sketch maps has marked in the composite sketch map where the most perceived landmarks and districts can be identified, and all the responses related to the questionnaire was simplified and summarized into a table.

Method 1.2: Scoring method (Long, Y. et.al., 2007)

Scoring method assess the accuracy of the map and frequency of elements. Since the basic street network was given to the people as the base map to increase the efficiency of the data collection process, following scoring method was used to analyze the data and prepare the composite map.

Scoring method to assess the accuracy and frequency of the landmarks-

Correctly drawn/labelled: 3 marks
Correctly labelled: 2 marks
Correctly drawn: 1 mark

Scoring method to assess the accuracy and frequency of the paths-

Correctly identified/labelled: 3 marks
Correctly identified: 2 marks
Correctly labelled: 1 mark

Analyzing method 2 for Spatial configuration

Method 2: Integration and connectivity maps created by DepthmapX (Version 0.8.0) software (Hillier, 1996)

Record the Spatial configuration of the context with the given computer-based drafted map. Objective method of data collection as the software previews the numeric values for the connectivity, visibility, and level of integration… etc.

The subjective human perception of the city could be assessed through cognitive maps by analyzing the imageability of the elements in the city such as landmarks, paths, and districts. Legibility through the city which is affected by its arrangement also impacts the human perception. Spatial configuration of the physical environment could be assessed through space syntax theories and generated mapping. Therefore, mixed-mode research approach will ensure the accuracy of the findings as well as prove the theoretical approaches in practical and real-world contexts.

Introduction to the Case Study

Given the focus on spatial cognition and configuration in historic urban settings, it's crucial to highlight the strong images and perceptions of both residents and visitors. The identified configuration patterns are expected to enhance the city's imageability. The historic grid city of Kandy, with its grid-iron spatial arrangement and strong perceptions from both residents and visitors, is chosen as the case study. This study will compare both qualitative and

quantitative findings, concluding with a composite map outlining the spatial cognition of both residents and visitors. Further discussions will explore how the findings justify the significance of specific landmarks and paths within the city's image.

Historical value of the city

City of Kandy can be identified as a World heritage city known for its unique cultural heritage and natural heritage which also considered the last royal residence and kingdom established to provide defense as the purpose. It was ruled under British colonial from 1815 – 1948.

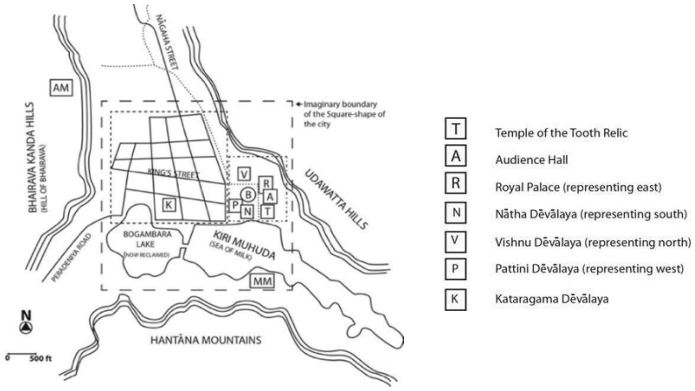


Fig. 2: Structure of the city
Source: Silva, 2017

Arrangement of the city

City was originally arranged as a grid by Devendra Mulachari and Malwathu, Asgiri vihara by two ends and royal officials' residences in the middle. (World heritage city of Kandy, 1999) Following are the major streets are named after the people who lived there, and landmarks located.

- Hetti Veediya – the street where chettiyars/ gold smiths lived
- Yatinuwara Veediya - the street where heirs to the throne lived
- Kotugodalla Veediya – the street which was reclaimed by earth-filling
- King Street – the street where the noblemen close to where the king lived
- Dalada Veediya – the street heading to the temple of the tooth
- Deva Veediya – the street which borders the temple and the devalas

1. Dalada Veediya
2. Yatinuwara Veediya
3. Kotugodalla Veediya
4. D. S. Senanayake Veediya
5. Colombo Street
6. Raja Veediya
7. Kumara Veediya
8. Cross Street
9. Hill Street
10. Temple Street
11. Deva Veediya
12. Wadugodapitiya Veediya
13. Peradeniya Road
14. S. W. R. D. Bandaranayake Mawatha
15. Market Street
16. Sri Vikrama Rajasinghe Mawatha
17. Lake round walking path
18. Sangaraja Mawatha
19. Wadugodapitiya Lane
20. Yatinuwara Lane
21. Castle Lane

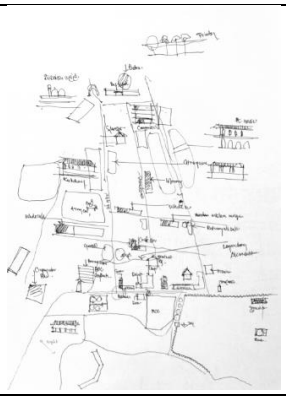
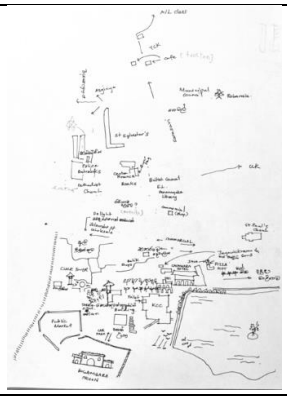
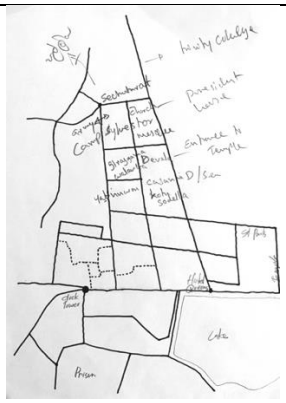
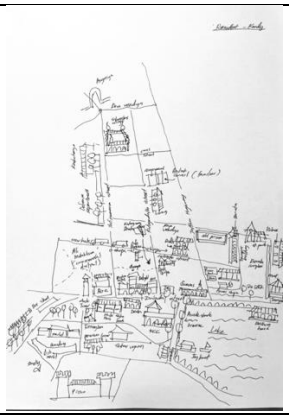
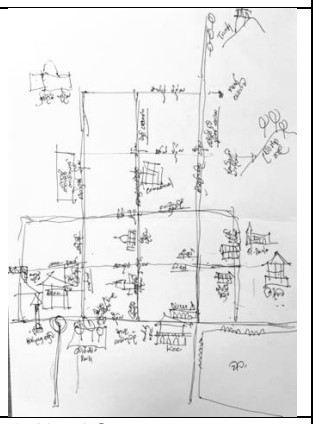
Fig. 3: Structure of the city
Source: Silva, 2017

Findings and Discussion

Findings: Spatial cognition

Following tables previews the findings of the data collected through the methods mentioned above.

Table 3: Findings through questionnaire: Residents
Source: Author

Resident: **1, 2, 3** **Questionnaire**	**2. A Living heritage city** **3. Temple of the tooth** **4. Dalada veediya: Nostalgia** **5. Open court in front of the Temple**	**2. Cultural city** **3. Dalada veediya** **4. sense of the history** **5. Clock Tower**	**2. Temple of the tooth** **3. Torrington park** **4. Cross streets: lost** **5. Temple of the tooth and lake**
Resident: 1, 2, 3 Sketch map			
Resident 4, 5, 6 Questionnaire	**2.** Temple of the tooth, lake **3.** Clock tower **4.** Familiar **5.** Temple of the tooth	**2.** Lake and shade trees **3.** Clock tower, Dalada veediya **4.** Comfortable **5.** Temple of the tooth	**2.** Building form, Religious places **3.** Lake round **4.** Certain **5.** Temple of the tooth
Resident 4, 5, 6 Sketch map			
Resident 7, 8, 9 Questionnaire	**2.** Temple of the tooth **3.** Dalada veediya **4.** Peaceful **5.** Building forms	**2.** Walakulu bamma **3.** KCC **4.** Congested **5.** Temple of the tooth	**2.** Hotel Queens **3.** Cargills building **4.** Lake round: calm **5.** Lake and temple

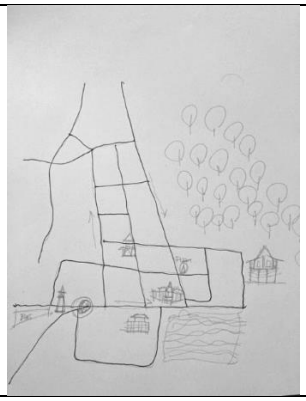
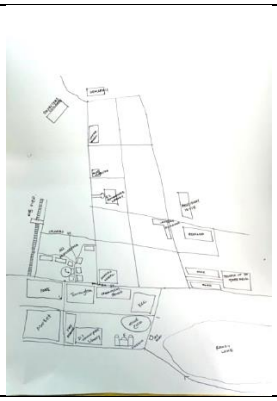
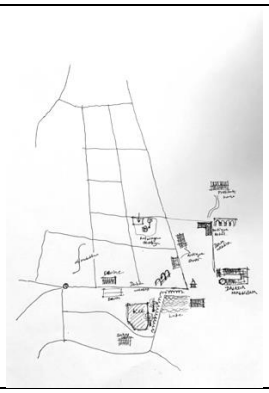
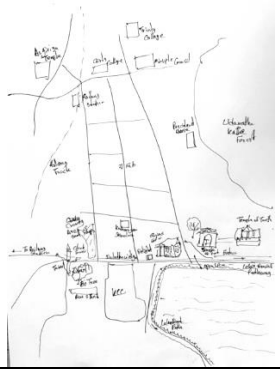
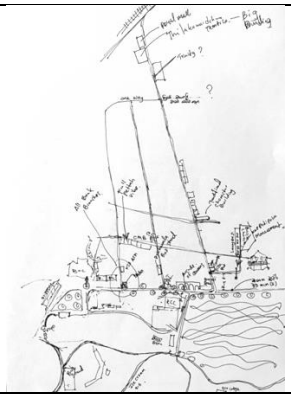
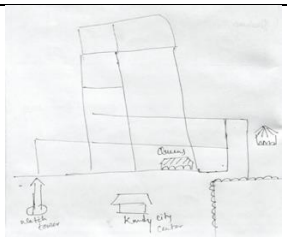
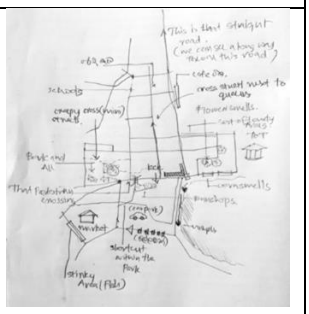
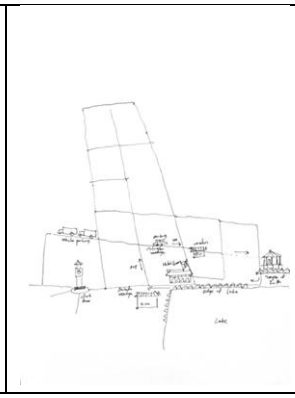
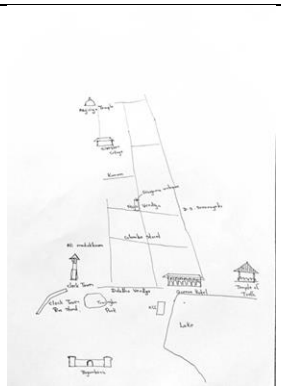
Resident 7, 8, 9 Sketch map			

Table 4: Findings through questionnaire: Visitors
Source: Author

Visitor: 1, 2, 3 Questionnaire	**2.** Lake round **3.** Dalada veediya, antique shops, palace **4.** Ali Mudukkuwa: Fancy **5.** Lake round	**2.**Temple of the tooth **3.**Lake round **4.**Congested **5.**Lake round	**2.**Congested city **3.**Commercial buildings **4.**Hard figure out paths **5.**Lake round
Visitor: 1, 2, 3 Sketch map			
Visitor 4, 5, 6 Questionnaire	**2.** KCC, Lake and Temple **3.** Dalada veediya **4.** Not aware **5.** Temple	**2.**Temple of the tooth **3.**Dalada veediya **4.**Congested **5.**Lake round	**2.**Temple of the tooth **3.**KCC, Dalada veediya **4.**Uncertain **5.**KCC entrance
Visitor 4, 5, 6 Sketch map			
Visitor 7, 8, 9 Questionnaire	**2.**Religious buildings **3.**Temple of the tooth **4.**Congested **5.**Hotel Queens	**2.**Temple of the tooth **3.**Hotel Queens **4.**Uncertain inside the grid **5.**Dalada veediya	**2.**Hotel Queens **3.**Old buildings **4.**Uncertain about the grid **5.**Clock tower

Visitor 7, 8, 9 Sketch map			

Findings: Spatial configuration

This section will present the syntactic maps generated with the DepthmapX software and the initial base map was created in AutoCAD software. The following diagram previews the generated maps using the space syntax theory, which shows both integration and connectivity maps in order. Both maps include axial lines representing the lines varying from dark red (which previews the highest integrated /connected lines) to Dark blue (which previews the lowest integrated /connected lines).

Integration map:

Fig. 4: Integration map, Grid city, Kandy
Source: Author

Discussion

Analyzed data: Spatial cognition

The collected data has been analyzed according to the scoring method for both landmarks and paths in the sketch map There are 9 respondents for each category and the highest mark is three, so the scoring classification will range from,

00 – 09: Low score
10 – 18 Medium score
19 – 27: High score

Further, the darkest shade highlighted elements are the most perceived by both user groups, which should be considered as high priority areas in the context, while lighter shade highlighted elements are highly perceived only by the residents which also should preserved and given priority.

Landmark maps:
Following table previews the analyzed score of each of landmark.

Table 5: Landmark scores- grid city, Kandy
Source: Author

Landmark	Resident		Visitor	
	Total	Score	Total	Score
Temple of the tooth	25	High	24	High
KCC	24	High	21	High
Clock tower	27	High	24	High
Kataragama devalaya	19	High	05	Low
Hotel Queens	24	High	27	High
Lake	27	High	24	High
BOC	12	Medium	03	Low
Wholesale strip	12	Medium	06	Low
Devon's restaurant	08	Low	03	Low
Queens bath	06	Low	03	Low
Royal palace	08	Low	00	Low
Army Regiment	11	Medium	00	Low
E.L.Senanayake library	15	Medium	00	Low
Giragama walawwa	08	Low	02	Low
Hemamali Girls College	03	Low	00	Low
Meera Makkam mosque	11	Medium	00	Low
St. Sylvester's college	18	Medium	03	Low
Kachcheri complex	14	Medium	00	Low
Commercial bank	09	Low	00	Low
Café divine street	06	Low	02	Low
Torrington Park	20	High	11	Medium
Ali Mudukkuwa	12	Medium	10	Medium
Sahas uyana	09	Low	13	Medium
St. Paul's church	15	Medium	00	Low
Lawyer building	06	Low	06	Low
Old steel bridge	06	Low	00	Low
Pizza hut	15	Medium	06	Low
Udawattakale	06	Low	00	Low

Out of the 28 landmarks, residents have scored 07 highest perceived landmarks, followed by 10 medium scores and 11 low score. While visitors have scores 05 highest perceived landmarks, followed by 03 medium scores and 20 low score. It can be seen that residents have marked more elements with higher accuracy compared with visitors.

Fig.5: Composite landmark maps – Resident vs. Visitors
Source: Author

Path maps:
Following table previews the analyzed score of each of path.

Table 6: Path scores- grid city, Kandy
Source: Author

Path	Resident		Visitor	
	Total	Score	Total	Score
Dalada veediya	22	High	24	High
Lake round path	09	Low	18	Medium
Yatinuwara veediya	21	High	08	Low
Kotugodalla veediya	16	Medium	08	Low
D.S. Senanayake veediya	19	High	15	Medium
Wadugodapitiya veediya	03	Low	00	Low
Colombo veediya	18	Medium	08	Low
Raja veediya	11	Medium	03	Low
Kumara veediya	02	Low	03	Low
Cross street	08	Low	00	Low
Hill street	10	Medium	00	Low
Deva veediya	05	Low	05	Low
Temple street	06	Low	06	Low
Sangaraja Mawatha	00	Low	00	Low
Peradeniya road	04	Low	04	Low
Sri Vickrama Rajasinghe Mawatha	06	Low	08	Low
S.W.R.D. Bandaranayake Mawatha	02	Low	02	Low
Market street	06	Low	02	Low
Castle lane	06	Low	00	Low
Yatinuwara lane	08	Low	08	Low
Wadugodapitiya lane	02	Low	00	Low

Out of the 21 paths, residents have scored 03 highest perceived paths, followed by 04 medium scores and 14 low score. While visitors have scores 01 highest perceived path, followed by 02 medium scores and 18 low score. It can be seen that residents have marked more elements with higher accuracy compared with visitors.

Fig.6: Composite path maps – Resident vs. Visitors
Source: Author

Composite maps

Following maps previews the composite maps of the analyzed data.

Fig.7: Composite maps – Resident vs. Visitors
Source: Author

Analyzed data: Spatial configuration

Colombo Street and the D. S. Senanayake veediya can be identified as the most integrated and connected street in the context which has unique identities when compare with other streets. Further Yatinuwara veediya, Kotugodalla veediya and Dalada veediya can be identified as most perceived streets in order.

Observations: Composite maps

Fig. 8: Composite maps for comparison, Resident vs. Visitors
Source: Author

Resident cognition:

Paths, which got the higher scores in the cognitive maps seem to be a few of the most integrated paths in the context. (Sri Dalada Veediya, Yatinuwara Veediya and D. S. Senanayake Veediya) Landmarks, which got higher scores in the cognitive maps seem to be located along the paths, which scored high in the cognitive maps as well as the most integrated paths. (Hotel Queens, Lake, Kandy City Centre, Torrington Park, and the clock tower) Considering the paths, Dalada Veediya, Yatinuwara Veediya and D. S. Senanayake Veediya; Dalada veediya can be identified as the main street in the network which leads to the temple of the tooth, while Yatinuwara veediya functions as a one-way path leading outward from the city and D. S. Senanayake Veediya functions as a one-way path leading inward to the city.

Visitor cognition:

Path, which got the higher score in the cognitive maps seem to be the most integrated path in the context.(Sri Dalada Veediya) Landmarks, which got higher scores in the cognitive maps seem to be located along the paths, which got the higher scores in the cognitive maps as well as the most integrated paths. (Hotel Queens, Lake, Kandy City Centre, and the clock tower) Considering the paths, Dalada Veediya which can be identified as the main street leads to the temple of the tooth and where the main landmarks are located by the sides.

Conclusion

The overall image of the grid city, Kandy including the most perceived landmarks and paths for both residents and visitors according to the analysis can be concluded and presented as follows,

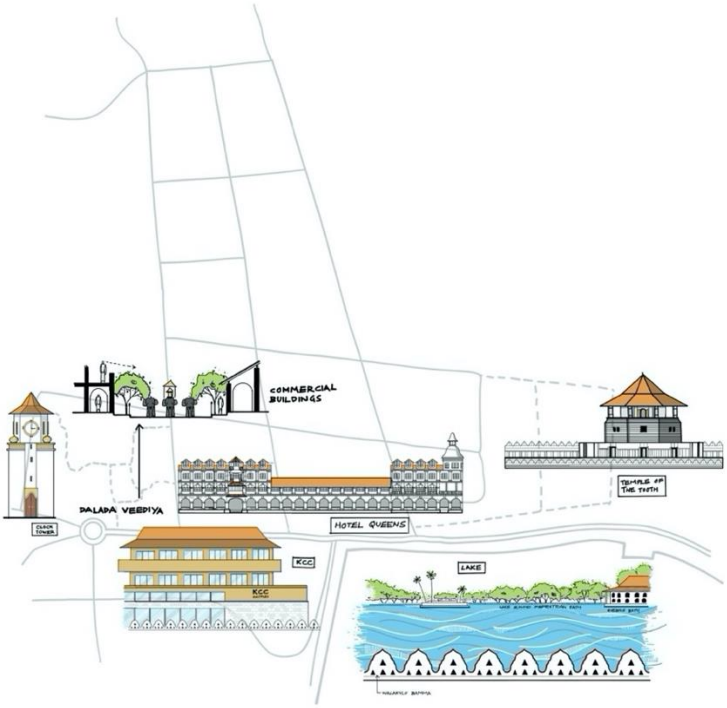


Fig. 9: Public image of the grid city, Kandy
Source: Author

Dalada Veediya stands out as a prominent street for both residents and visitors due to its unique building facades, shade trees, and connecting streets. It intersects with major paths and houses significant landmarks, like the Temple of the Tooth, Hotel Queens, Kandy Lake, Kandy City Centre (KCC), and the clock tower. The Temple of the Tooth attracts many for religious purposes, the lake serves as a natural landmark, and the clock tower functions as a main wayfinding marker. Further Hotel Queens can be identified as a historic landmark, while KCC and Torrington Park offer commercial and social spaces.

Research on spatial cognition shows that city configurations are perceived differently by residents and visitors based on familiarity and personal experiences. Residents' cognitive maps are more detailed, shaped by daily routines and past experiences. Visitors' maps focus on their journey and significant elements, like landmarks and paths. The study, conducted in Kandy's historic grid city, illustrates that historic cities offer distinct physical images for each visitor and embodied memories for residents.

Visitors' spatial cognition aligns more with syntactic maps, relying on spatial arrangements. Landmarks' significance often relates to their orientation on perceived paths and specific nodes in grid paths, indicating that city spatial cognition is closely tied to its configuration.

Key factors for urban elements influencing city perception include:

For Landmarks:

- Historical significance and functions
- Physical features (height, color, mass)

For Paths:

- Regularity of use (personal experience)
- Buildings along the path
- Physical features (building heights, façade character, path orientation)

Development should enhance the perceived character of spaces, not just focus on prominent areas. In Kandy, Dalada Veediya and its significance comes from its location, access, and frequent human movement. Potential paths should be analyzed based on building use, character, vehicular access, and human movement to enhance their character.

The study concludes with insights for urban planning to preserve historic cities by understanding city images, element interrelations, and arrangements. Future research could include more varied respondents, such as urban planners, institutional figures, and historical building professionals, to increase accuracy.

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