The image of public space on planned housing based on environmental and behavior cognition mapping (case study: Cemara Asri Estate)

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Abstract. Public spaces in a planned housing is a place of social interaction for every visitor of public space. The research on public space image uses four public spaces that meet the criteria of public space such as pedestrian sidewalks, public park, water front and worship place. Research on the perception of public space is interesting to investigate because housing development is part of the forming of a society that should design with proper architectural considerations. The purpose of this research is to know the image of public space on the planned housing in Medan City based on the mapping of environmental and behavior cognition and to know the difference between the image that happened to four group respondent. The research method of architecture used in this research is a descriptive qualitative method with case study approach (most similar case). Analysis of data used using mental maps and questionnaires. Then the image of public space is formed based on the elements of public space, wayfinding, route choice, and movement. The image difference that occurs to the housing residents and architecture students, design and planning are outstanding, visitors to the public housing space is good, people who have never visited the public space is inadequate.

Keywords: public space, image, mental map

1. Introduction
Public spaces in a planned housing are supporting facilities and infrastructures whose presence greatly influences the housing habits that are perceived to be evident in the activity of the public space and unconsciously perceived to exist and its benefits to the housing residents. Every public space in the estate has its characteristics that embedded in every occupants about the image of the public space. The image determined by the pattern and structure of the physical environment which in its development influenced by the social, economic, cultural, institutional, customary and political factors that will ultimately also affect the physical performance. A housing that has no high public image or identity, the community or residents of housing tend to have relatively equal interactions and experience of space in the public space [1]. Man as a rational creature is always trying to structure, understand and give meaning to the surrounding environment. Environmental cognition is determined by three major factors: organismic, ecological and cultural; the three factors interact affecting one's perception process to the surrounding environment [2].
2. Literature Review

2.1. Public space
Public space is a necessary element in the existence of a community environment, especially the housing environment. Public areas have an important role because their presence is used to perform many activities as well as a binding and connecting space to the surrounding environment. The length of time a person is in a public space shows the comfort created when using the open space [3] and the time of public space usage is influenced by what the place offers at a given time [4]. Facilities in the public space usually used as a place of activities of sports, play, ceremonies, and festivals. The purpose of public space is the social function that wants to be formed. Public space as a social space, forms the basis of small social interactions that grow into greater social interaction into communities [5].

2.2. Elements of public space
A public space formed by single elements that are interconnected which is one of the factors supporting the success of open space. The Lynch image element [6] consists of paths, districts, edges, landmarks, and nodes. Where these five elements can found in many examples, one is public space. The element of public space as a determinant of the image of the open space is essential, some elements of public space studied based on the theory of Kevin Lynch, and some other researchers are:

- Landmark in the form of a plaza;
- Path in the form of roads, traffic features, distance;
- District in the form of land use cues, building;
- Edge in the form of point boundaries;
- Nodes in the form of routes.

The five elements above is the relationship between discrete elements or single elements referred to as relational elements or related elements formed by the perception or movement of a person in a public space.

2.3. The image based on environmental and behavior cognition
The environmental image summarizes things such as the situation or image state of an object, the purpose of the image of an activity and the use of a particular image on a particular object, which is a fundamental process of recognition, identification, and control of the human activity [7]. According to Lynch [6], there are five elements of image formation of the environment, including paths, edges, districts, nodes, and landmarks. The way to describe and recognize the image of an environment is to align the relationships between spaces in the environment. The image will create an impression for the visitors through the five senses and the physical experience that creates a cognitive awareness of a location. The interaction between the visitors and the physical elements of an environment will result in the cognitive experience stored in the visitor's memory. Cognition is the way humans use to explain how humans understand, organize and study the environment and use mental maps [8]. According to Kitchin [9], mental maps are used to examine, recognize, predict the environment and as a pointer to spatial behavior (one of which is to locate specific locations) within an environment.

2.4 Mental map
The first mental map used in a journal entitled "Cognitive Maps in Mice and Man" by Tolman, which was subsequently adopted by social researchers and behavior. The basis for the development of mental maps begins with its usefulness to illustrate how humans mingle and interact with their environment. Environmental interrelationship with people is mutually adjusting, and with human cognitive ability, humans will always try to align themselves with their environment [10].
2.5. Wayfinding, rote choice and movement

Wayfinding is the way used to find the street or path taken to a location and find its place. There are five (5) factors in the wayfinding description, including knowing where existence, knowing the purpose, showing the route to the place, recognizing the place when it has arrived and been able to find a way home [11]. The process of the above five factors helps to understand and recognize the place, in contrast to Golledge's [12] opinion of wayfinding and navigation which are spelled out into two different things based on the way or process and place scale. Respondents' knowledge of the environment in which they are located also influences the route chosen by the respondent. A preliminary study conducted by Maguire [13] showed no difference that occurred when the respondent was given a test of the opinion of the selected route with the actual route option used. Meanwhile, human movement is an economic activity that expects the nearest road and the shortest distance to be taken [14]. Movement is known as the beginning of spatial and wayfinding cognition in which the spatial perception of a person depends on its movement within an area.

Here is a scheme of research that makes the public space as the subject of research (Figure 4):
3. Research Methodology

3.1. Research design
The research methodology used in this study is a descriptive method with a qualitative approach, that is research which presents data in the relationship between variables, the difference between facts, influence on a condition, etc. While the data analysis method used is the case study approach is the most-similar case plan. Gerring's most-similar case method [15] is an approach that yields theoretical conclusions by looking at striking differences in a case based on several equations of the factors/variables used.

This research conducted several steps. The first step is doing research preparation in the form of literature study to get the research variables. The preliminary survey of research location to choose the place of research. Documenting the photos for the questionnaire, and selecting the sample based on observations. Then do the collecting data in the form. The identification of data gathering method used, that is field observation and questioner, actively doing questionnaires distribution and documenting activity in four selected research location and data processing in the form of analysis of research data to get the element of public space, wayfinding, route choice, and movement. Data processing performed in the shape of tabulation of respondent profile, questionnaire analysis using method of analysis of coding and also Likert analysis.

3.2. Data collecting
Sampling in this study using purposive sampling (purposive sampling), the source of the sample is determined by several considerations to produce various data [16]. In the study of images by Fakeye and Crompton [17], there are significant differences between the three groups of respondents to the image formed, the three groups of respondents are first-timers, who have never visited (a non-visitors), and people who repeatedly visit the place (repeater). Meanwhile, there is a difference of perception.
between architects and non-architects about property design [18]. There is a complicated difference from the way students of architecture, design, and planning when assessing a building facade compared with Other engineering students [19]. The results of the literature studies above show that with various variations of respondents, expected to be seen the difference of image that occurs between the groups of respondents.

So this study also used variations of respondents to achieve a significant diversity/variation of the variables found. Grouping of the samples are: (1). Housing resident called Respondent Group A. (2). Visitor of public housing space referred to Group Respondent B. (3). People who have never visited public housing area referred to Group of Respondents C (4). Student majoring in Architecture, Design, and Planning. referred to Respondent Group D.

Meanwhile, to obtain criteria of respondent A, according to Aryanto [16], respondents of the study of the selected housing residents are those who meet the following criteria: (1) The resident who lives in the estate and knows about the estate and (2). Duration of at least three months as a reference of residents have been familiar and adapted to the housing environment. To obtain the criteria of respondents B and C, according to Fakeye and Crompton [7], survey respondents from visitors to residential public spaces and people who have never visited the chosen public space are those who meet the following criteria: (1).The selected visitors are those who have attended the open space for two years or more. (2). People who have not visited (non-visitor) based on the results asked the visitors to the public space in the form of friends or colleagues who are interested visit the public space. And to get the criteria of respondent D, research respondents from the students of architecture, design, and planning chosen are last year in university (semester 7 or 8) [19]. The selection of respondents for group A to D based on Roscoe’s theory in Sekaran [20] in example sample size of 30 and less than 500 is valid for most studies and if the sample consists of sub-samples, a minimum sample size of 30 samples per Sub sample category. The sample size used in this study is 120 respondents, with 30 respondents for each sub sample or group of those surveyed. The categorization of observation time based on [21] study on public space design guidance based on the difference of time of its use. The research explains that the observation time (time of public space usage) varies, showing the characteristic of the visitor of its public space.

The research area located in Cemara Asri Estate. The estate developed by PT Kurnia Sampali Asri. The housing located in Sampali, Percut Sei Tuan Subdistrict, Deli Serdang Regency. Cemara Asri Estate located on the outskirts of Medan, precisely at Jalan Cemara, Deli Serdang. This housing is right beside the toll gate, so it has easier access and close to Kuala Namu International Airport. Based on the results of literature studies on the function of public spaces, types of public spaces and typology of public spaces, then selected four research sites at Cemara Asri Estate that meet the requirements of the function, type and tipology of place as open space. Public spaces selected as research area are the main street into the cemara asri estate, cemara asri square, bolevard bird park, and maha vihara maitreya.

### 3.3. Data analysis

The data analysis method used is the most-similar case approach. The results of primary data collection and secondary data interpreted in the form of extensive questionnaires. The next stage of analysis is done by chronological analysis (mental map) and general data analysis (tabulation, coding and Likert scale). The chronological analysis will refer to field findings of discrete elements and relational elements based on observations and maps illustrated by respondents. Then the general data analysis obtained in the form of questionnaires about the elements of public space, personal experience in the public space, etc. will be explained with drawings of observations and drawing surveys. Both data results are then analyzed based on the elements of the formation of public space, wayfinding, route choice is also movement in the open space that will produce the image of public space on the housing. Also to find the difference of image that occurs to the residents of housing, visitors of public space housing, people who have never visited the estate and architecture students,
design planning by comparing the results of mapping obtained. Data and statistical description of 120 respondents tabulated into the table below:

Table 1. Respondents identity distribution table.

| No | DATA | SUBSAMPEL A | SUBSAMPEL B | SUBSAMPEL C | SUBSAMPEL D |
|----|------|-------------|-------------|-------------|-------------|
|    |      | n | % | n | % | n | % | n | % |
| 1  | Gender       |   |   |   |   |   |   |   |   |
|    | Male         | 17 | 56.67 | 21 | 70 | 17 | 56.67 | 15 | 50 |
|    | Female       | 13 | 43.33 | 9  | 30 | 13 | 43.33 | 15 | 50 |
| 2  | Age          |   |   |   |   |   |   |   |   |
|    | < 20         | 3  | 10 | 5  | 16.67 | 2 | 6.67 | 2 | 6.67 |
|    | 21 – 30      | 8  | 26.67 | 15 | 50 | 9  | 30 | 28 | 93.33 |
|    | 31 – 40      | 13 | 43.33 | 8  | 26.66 | 7 | 23.33 | - | - |
|    | > 41         | 6  | 20 | 2  | 6.67 | 12 | 40 | - | - |
| 3  | Job          |   |   |   |   |   |   |   |   |
|    | Entreprenuer | 6  | 20 | 13 | 43.34 | 5 | 16.67 | - | - |
|    | Government employees | - | - | 7  | 23.33 | 6 | 20 | - | - |
|    | Private employees | 12 | 40 | - | - | 4  | 13.33 | - | - |
|    | etc          | 12 | 40 | 10 | 33.33 | 15 | 50 | 30 | 100 |
| 4  | Education    |   |   |   |   |   |   |   |   |
|    | SD           | - | - | - | - | - | - | - | - |
|    | SMP / SMA    | 6  | 20 | 12 | 40 | 9  | 30 | - | - |
|    | D3           | 2  | 6.67 | - | - | 3  | 10 | - | - |
|    | S1           | 17 | 56.67 | 18 | 60 | 15 | 50 | 30 | 100 |
|    | S2 / S3      | 5  | 16.67 | - | - | 3  | 10 | - | - |
| 5  | Income / mount (Rp) |   |   |   |   |   |   |   |   |
|    | < 3.000.000; | - | - | 15 | 50 | 6  | 20 | 7 | 23.33 |
|    | 4.000.000; - 7.000.000; | 1 | 3.33 | 3  | 10 | 10 | 33.33 | - | - |
|    | 8.000.000; - 11.000.000; | 25 | 83.34 | - | - | 6  | 20 | - | - |
|    | etc          | 4  | 13.33 | 12 | 40 | 8  | 26.67 | 23 | 76.67 |

Data subsample A, subsample B, subsample C and subsample D analyzed by sex, age, occupation, education, and income per month. From the table 1, the spread of male and female gender fairly evenly. The most respondent age at 21 - 30 years old, there are 60 respondents, indicated that the public spaces in Cemara Asri estate were young people aged 21-30 years, according to the observation of field research that young people aged 21-30 years like to spend time in the public spaces of Cemara Asri estate. The distribution of respondents' research type is also seen dominated by young people who have freelancer or student, 67 people choose 'other' job type. The dissemination of education data of respondents also seen centered on undergraduate level as many as 80 respondents who are or have undergone such education, the rest are scattered junior high school education / high school, D3, and S2. For respondent data related to income each month, respondents tend to choose 'other' option as many as 47 respondents. From the description of data and description of statistics of respondents above, that the distribution of public spaces visitors Cemara Asri estate tend to be interested in young age 21-30 years.
4. Findings

4.1. Elements of public space on Cemara Asri Estate

Discrete elements and relational elements are essential elements in mental maps because mental maps are the development of someone perception of movement in the public space [22]. There are five relational elements formed from several discrete elements, including landmarks such as plazas, paths, traffic features, distance, districts in the kind of land use cues, building, edge point boundaries, and nodes of routes. First, The Boulevard road located on the front of Cemara Asri Estate as the largest entry access to housing. There is some uniqueness of the Boulevard road, which is on the 'path' element in the form of discrete elements, shop, bridge crossing, trenches, outdoor food court, road width, etc. While the character / physical characteristics of the markers of the road Boulevard is 'building' elements that look along the left and right of the Boulevard street is shop houses which are a cafe, supermarket, salon and other means of trading. The second, Cemara Asri square locates in the middle of Cemara Asri Estate as a current divider inside the residential street and as a playground. There is some uniqueness of the cemara asri square, namely the 'landmark' element of discrete elements, parks/fields, reflection stones, square entrance, etc. Second, there is also a personal experience of the multi functional square such as for sports, gymnastics, exhibitions and fundraising events. While the physical character/characteristic of the cemara asri square are 'edge' element that appears to entire square, where parks, trees, fields, jogging tracks, reflection stones and other elements create a comfortable composition for each user.

Third, the public spaces in the Boulevard bird park located at the back of Cemara Asri Estate as an animal conservation area. There is some uniqueness of the Boulevard bird park, which is in the 'landmark' element of discrete elements, lakes, trees, animals such as birds, fish, snakes, etc. There is also a personal experience of tourist attraction from the separate parts of this bird park. With the existence of various types of animals, visitors are interested in spending time in this bird park. While the physical character of the boulevard bird park marker is the 'edge' element that appears to form an entire roundabout, where parks, trees, lakes, animal houses and other elements create a comfortable composition for every user/visitor of the Boulevard bird park. And lastly, in the Maha Vihara Maitreya is located at the back of Cemara Asri Estate as a place of worship the majority of residents of the housing. There is some uniqueness of the Maha Vihara Maitreya, namely the 'landmark' element of discrete elements, statues, ornaments, gazebo, field, etc. There is also a personal experience of the multi functional monastery as well as a place of worship as well as tourist attractions for residential visitors. The characteristic marker of the Maha Vihara Maitreya is the 'building' element and the 'landmark' element. These two buildings are so high existence compared to other buildings around it. So the elements found in every public space is the potential of existing public spaces that have be maintained and developed. Element path and building which is a hallmark of the Boulevard Road. Landmark and edge elements are characteristic of Cemara Asri Square and Boulevard Bird Parks, as well as landmark and building elements that show the specificity of the Maha Vihara Maitreya.

4.2. Wayfinding, route choice and movement in Cemara Asri Estate

Based on the results of observation and distribution of questionnaires, beautiful pine housing including adequate housing has a signpost or signage that can help residents of housing and housing visitors. For a sign of structural concept differences seen from the interpretation of respondents to the housing environment, where the beautiful cypress roundabout on the map is the main flow breaker in the estate, to the roads of collectors in the vicinity. Accessibility to residential public spaces tends to be easy with the number of respondents choosing the main roads for in and out of the housing. (Figure 5). The statement supported by the concept of a good road network, which is the presence of axis or axis is evident to direct visitors to the public areas in a beautiful pine homes without having to get off from his vehicle.
Based on the results of field observations and mental image drawings of the questionnaire distributed, there was a lot of repetition in the area that became the vocal attention in the Cemara Asri estate. Some streets or roads used for recurrent routes and different routes are also used by respondents already very familiar with the way. Based on the map image below, the path chosen by each group of respondents will differ based on the decisions, interests, and objectives of each respondent. There are several types of route taking based on three groups of respondents. Here's a picture of mental map route choice in the public spaces in Cemara Asri Estate (Figure 6).

Based on field observations and mental image drawings of the questionnaires distributed, respondents tend to use the main roads of the housing to move to public spaces in Cemara Asri estate. The movement of respondents depends on the purpose, and the urgency to get to a place, as well as the majority of movement is triggered by environmental patterns, road networks and the flow of movement created (Figure 7).

**Figure 5.** Wayfinding map of Cemara Asri Estate.

**Figure 6.** Route Choice map of Cemara Asri Estate.

**Figure 7.** Movement map of Cemara Asri Estate.
Based on the Figure 7, a movement influenced by the shape of the pattern of the residential road network, then the quality of good road network design will create a change that can accommodate the interests of roads/streets users. In the Cemara Asri estate, grid road network pattern with the concept of a residential street in the form of the boulevard. The idea of a road on housing provides many benefits to pedestrian users (slow lane roads), nor does it interfere too much with the vehicle path (fast track).

5. Discussion and Analysis

5.1. The differences of image between respondent’s group

Based on the Figure 8, respondent group A can explore the public spaces in the housing very well. They know the limits and material of the open space well and also know the surroundings well that cause the acquisition of many route choice. The responses of group A about nodes and junctions are straightforward to recognize and help the movement within the housing.

![Figure 8. Respondent A perception.](image)

Based on Figure 9, respondent group B can explore the public spaces within the housing well, lack familiarity with boundaries and less material open space will affect familiar surroundings well which causes the easiest and recurring route when visiting public space. In response group B the existence of the public space that causes them to visit the beautiful pine housing and form a good image of the housing.

![Figure 9. Respondent B perception.](image)
Based on Figure 10 respondents group C is less able to explore the public spaces in the housing well, less familiar with the boundaries and less material public space well as well as the surrounding environment, information about the open space obtained based on stories, narratives elaboration of others about the public area. In response group B - the uniqueness of public space that encourages the group of respondents C can recognize open spaces residential pine beautiful, although the image is not well formed.

![Figure 10. Respondent C perception.](image)

Based on Figure 11, the respondent group D can explore the public spaces within the housing very well, know the limits and materials of the open space will also recognize the surroundings with experience and cognitive ability better than other groups of respondents. In the response group, D location attractiveness and the means - facilities in this public space can attract many visitors from the group of those surveyed because the image of open space formed very well.

![Figure 11. Respondent D perception.](image)

6. Conclusions and Recommendations
The image of public space on planned housing in Medan City based on environmental cognition mapping and behavior formed by Element of Public Space, Wayfinding, Route Choice, Movement And the image difference that occurs to residents of housing, visitors to public housing spaces, people who have never visited the estate and architecture students, design and planning are: (Figure 12)
Base on Figure 12, the housing residents and architecture students, design and planning are outstanding, visitors to the public housing space is good, people who have never visited the public space is inadequate. And Architectural design recommendations for public spaces of cemara asri are the use of street furniture in public spaces, the use of boulevard concepts on residential roads, the use of parking spaces for public spaces, the use of axis concepts on the design of public spaces, and adding physical appeal and non-attraction physically.

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