Evaluating accessibility to city parks utilizing a space syntax method. A case study: city parks in Malang city

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Abstract. The government of Malang city has developed public space by increasing the number of city parks and revitalising the existing parks, functioned as active parks and city forests. Despite the development of individual city parks, about the debate has circulated regarding how the parks are integrated with the city’s spatial system. The focus of this research comprises the evaluation of city parks performance according to the parks’ relative position in the city’s spatial system. This study applies the two variables, including: the relative position of city parks and the visit frequency. The relative position is identified by employing the notion of spatial configuration and space syntax. The visit frequency is explored by utilizing questionnaires. The correlation between the two variables is investigated by using Pearson Product Moment. The research indicates that there is a correlation between the two variables. This finding additionally proves that the spatial configuration determined access to city parks, thereby encouraging the visits. Further, this study has navigated some other motives for the visits in addition to the access.

1. Introduction

An urban problem has been generally associated with spatial configuration generating a malfunction in the urban spatial system. A typical problem includes a lower performance of public facility, since the spatial system could not provide an optimum accessibility, leading to other problems such as the overuse of motorized vehicles, the decline of pedestrian activities and the budget wasting on unnecessary development.

As a public facility, green open space leads to higher demands for rejuvenating urban ecology as well as supporting public’s physical and mental health. In accordance with such notion, the spatial planning act of the Republic of Indonesia has mandated that a city must have green open space at minimum 30% of the total urban area, including 20% public green open space and 10% private green open space [1]. The city park refers to a typically public green open space that has multiple roles, such as: ecological, recreational and functional roles [2].

In Malang city, the city parks are functioned as active parks and city forest [3]. The types of development process were various, in which; Singha Merjosari Park was developed by using the green city program (P2KH) and several other parks were established by using CSR such as in Merbabu, Kunang-Kunang and Trunojoyo parks. These parks were developed from the existed parks or park revitalizations. In turn, the parks become an affordable solution for family recreation that offers various themes equipped with their supporting facilities.
Despite the development of individual parks, the provision of city parks also is urged to concern with the service range and accessibility as indicated in Indonesia National Standard (SNI) number 03-1733-2004. This research particularly concerns with the spatial configuration as an indicator of service range through the relative position of each city parks in the city road network as suggested by [4,5]. The implemented analysis of spatial configuration in this research was space syntax [6]. This investigation aimed at proving the correlation between the city’s spatial configuration and the visits to city parks. The result was expected to contribute in developing the approach to planning city parks, providing better access and creating more efficient mobility.

This research was situated in Malang city with 22 city parks as study objects. The parks were located in the five selected districts, which were: 4 parks in Blimbing, 3 parks in Lowokwaru, 2 parks in Sukun, 10 parks in Klojen and 3 parks in Kedungkandang.

2. Methodology
Spatial configuration refers to an intrinsic element of a spatial system that provides efficiency in mobility between every location in a city. Scholars have argued that there is a relationship between the levels of accessibility in an urban area with the levels of pedestrian activities. Spatial closeness is predicted by implemented the integration value [7]. In addition, the condition of land use becomes a supporting factor for pedestrian activities, thereby indicating a correlation between spatial configuration and pedestrian activities [4,6,8]. On the basis of this theoretical consideration, this research has formulated hypothesis as follows:

H0 : There is no correlation between spatial configuration as represented by integration value and the number of visits to city parks.

H1 : There is a correlation between spatial configuration and the number of visits to city parks.

This research implements Pearson Product Moment to prove the hypothesis and to examine the level of correlation [9]. Variables used in the analysis are as follows:
1. Spatial integration. Integration is the global property of spatial closeness associated with the relative position of each space towards all other spaces in a spatial configuration [10,11]. The integration value is an immediate result of space syntax analysis on the road network of Malang city. The implemented software to run space syntax analysis is Depthmap with input in the form of axial line representing the street network.

2. Visits to city parks. The visit is measured through the questionnaires observing the number of visits to city parks. Due to the Covid-19 pandemic, the sampling method is the convenience sampling to gather the respondents from communities or population groups that can be easily reached by researcher team. The researcher team further spreads the questionnaires using Google form to population groups in each district, while sustaining the balance of respondent number across the district. The questionnaires questioned the respondents to choose the frequently visited city parks along with the reasons. This survey lasted for 2 months involving the 127 respondents.

3. Results and discussions
3.1. Respondents’ experience in using city parks
The questionnaire survey gathered perceptions from the 127 respondents. Regarding the first question, the respondents selected the frequently visited city parks. The following figure presents the answers distribution.
Figure 1. The frequently visited city parks according to the questionnaire surveys
Source: Analysis, 2021

According the previous chart, Alun-Alun Tugu was the most visited city park (81.1%) and the least visited one was Mega Mendung park (3.94%). The rate of visit was influenced by several motivations as depicted on the following chart.

Figure 2. Respondents’ motivation for visiting the city parks
Source: Analysis, 2021

According to the previous chart, the dominant motivations include the aesthetic, unique and interesting parks (49.61%), comfortable places for sport (48.82%) and comfortable places for gathering (48.03%). On the other hand, motivations associated with the closeness to public facilities, home and working places indicate a lower proportion at 18.11% to 30.71%. The data further depicts
that in the perspective of respondents’ perception, the quality of city parks becomes the prominent motivation for visiting the city parks. As suggested by Evans et al. [12] and Siregar [13], the quality and landscape furniture of public space particularly city parks are essential to the public’s preference.

3.2. Spatial configuration

This study utilized the space syntax to analyze the linkage pattern between city parks and each part of Malang city’s spatial configuration. In a city, the street network becomes a primary urban object forming spatial configuration [14] with axial line as its abstraction [10].

The spatial configuration of Malang city comprises the 3678 axial lines representing the roads in the city’s spatial system. Using space syntax analysis, this study navigated that the integration values of Malang’s spatial configuration were at a range between 0.59 (the highest) to -1.00 (the lowest). The following figure depicts the distribution of integrity values as the attribute of each axial line.

![Axial line map depicting the distribution of integration values](source: analysis, 2021)

The integration values are marked in a color gradation between light red (the most integrated axial line) and dark blue (the least integrated axial line). Roads with the highest integration value are depicted in Klojen, Blimbing and Lowokwaru districts. The other two districts, Kedungkandang and Sukun, tend to have the moderate and lower integration value. Roads with the highest integration value are indicated in Letjen Sutoyo, J.A. Suprapto, Basuki Rahmat and Gatot Subroto at 0.59 – 0.66 (light red). The red axial lines imply that these roads mark a central position in Malang’s spatial configuration leading to more accessible roads from all other parts of the city. From the city center, the integration values gradually decrease until reaching the peripheral areas of private housings in border areas such as Merjosari and Cemorokandang areas.

The previous map also indicates the relative position of each city park from axial lines. The following figure depicts the integration values adjacent to each city park.
Figure 4. The distribution of integration values adjacent to each city park
Source: Analysis, 2021

Parks with the highest integration value are depicted in Bhumi Purwantoro Agung park and Rampal square in Blimbing district, and Trunojoyo park in Klojen district. On the other hand, parks with the lowest integration value are depicted in Merjosari district, such as in Singha Merjosari Park and Tata Surya Park.

3.3. Spatial configuration
The analysis used in this step was Pearson Product Moment, calculated by using ‘Pearson’ formula in Microsoft Excel. The Pearson analysis produced R-value at 0.515. The product moment table with n = 22 and the level of confidence at 5% indicated a value at 0.413. In this case, H0 was rejected because the R-value > R-table. As a result, there was a correlation between integration value and the number of visits to city parks. The interpretation was continued by calculating determinant coefficient (r²). The result of Pearson analysis was the R-value at 0.515 and the r² at 0.266. The value of 0.266 indicated the determinant coefficient between the two variables at 0.266, signifying that the variance present in the visit of city parks are explainable by variance in the integration value at 26.6% and other factors might influence the visits by 73.4%. This determinant coefficient is thus considered low.

The significant correlation in low category suggests that to certain extent, spatial configuration contributes to the access to city parks. The respondents could easily visit the city parks located at the most integrated roads such as Alun-Alun Tugu and Idjen Boulevard, because the roads are located in the center of Malang’s spatial configuration that has the highest closeness to any other parts of the city than the peripheral areas. Hence, the spatial configuration enables a potential to public space for allowing people engagement [15]. The spatial configuration hence increases the possibility of people from different position engaged in particular public space [5].

Meanwhile, the low correlation indicates the presence of other factors motivating the visits other than due to the spatial closeness. The questionnaires reveal the factors representing the park quality, including: as aesthetic (49.61%), comfort (48.82% and 48.03%) and activity flexibility (47.24%) as dominant motivations, compared to spatial closeness with 30.71%. This finding suggests that the presence of people in public space depends on its spatial and environmental quality [16].

The result suggests that spatial configuration and park quality have an important role in the provision and service of city parks. Spatial configuration supports the accessibility and the park quality contribute to respondent’s motivation for utilizing the city parks.
4. Conclusion

Roads with the higher integration value represent the central area of Malang’s spatial configuration. The value further indicates more accessible area from all other parts in the city. The most integrated roads of Malang city are stretched from the northern area to the southern area. The integration value decreases to the lowest value in the peripheral area particularly in the gated housings.

In sum, the analysis proved that there is a correlation between spatial configuration and the visits to city parks. Although the correlation is low, it is argued that the relative position of parks in the city’s spatial configuration influences the closeness of city parks to the respondents’ locations. In addition to the closeness, the research also navigated other factors representing the park quality, such as aesthetic, comfort and activity flexibility.

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