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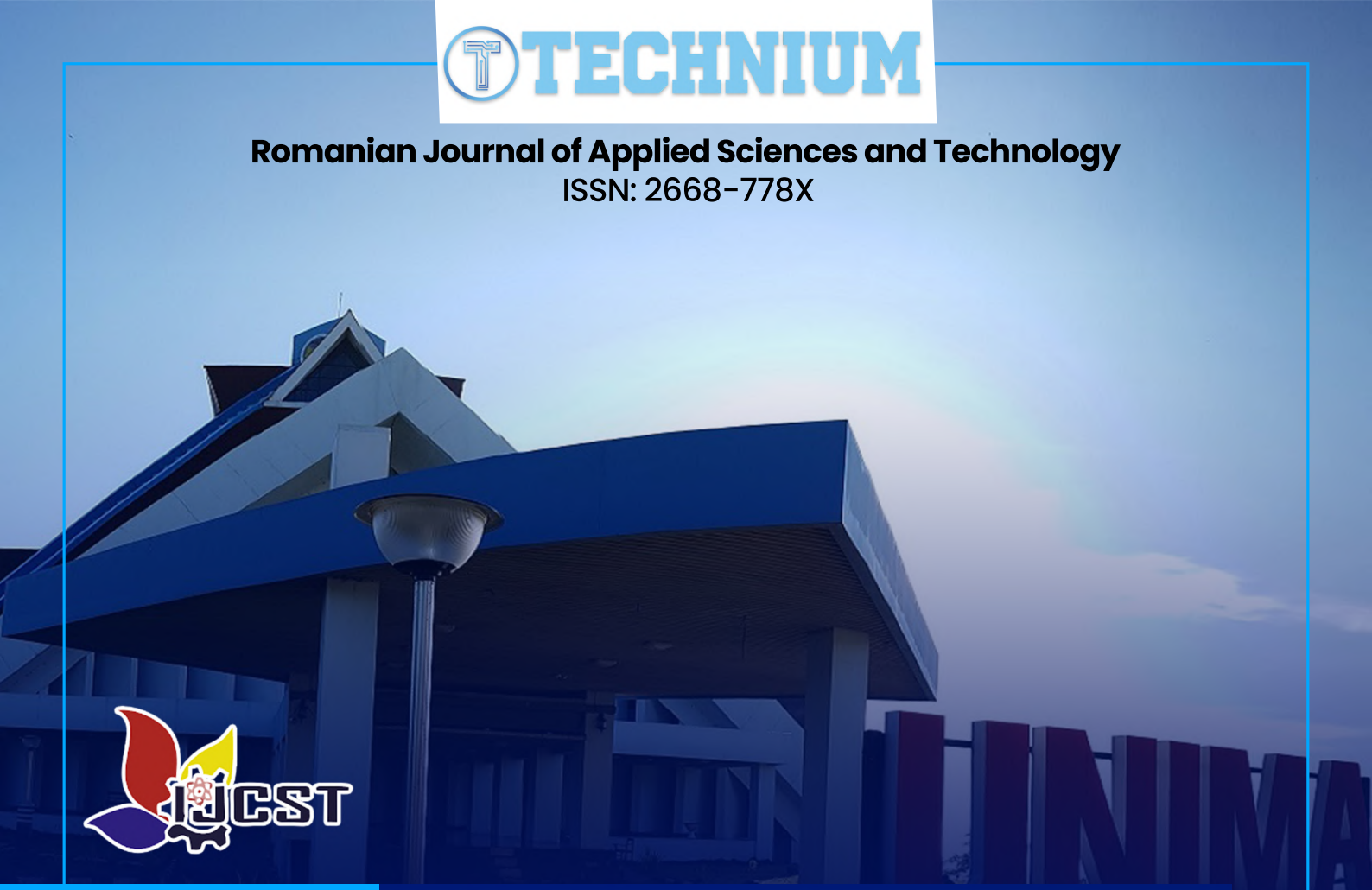

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Measuring the Spatial Configuration of the Center Point of Indonesia Using Space Syntax

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Abstract. This study aims to analyse the spatial configuration caused by the development and urbanisation that occurred in Makassar, especially in the Center Point of Indonesia area. The method used in the study uses a space syntax approach that provides graphic analysis results that show the relationship between the built environment and human activities in space. The city spatial plan map in the Center Point of Indonesia by 2030 area was analysed using Depthmap X. The syntactic measure used is integration and choice, both globally (Rn) and locally (R3). The results of the analysis conducted show that the Center Point of Indonesia area itself does not have a high value of integration and choice both globally and locally, but the roads that connect the area, namely Metro Tanjung Bunga Road and Cenderawasih Road, are the most integrated roads.

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1 Introduction

The rapid development of cities in Indonesia continues in the hope that it will spur social, cultural, and economic growth. Makassar, one of the major cities in Indonesia, is one of them. Through the Center Point of Indonesia project, which is built on a reclamation and waterfront area, Makassar continues to develop in order to fulfil the slogan of Makassar City: "A Worldworld city.

The significant development of Makassar in the last few years has not only had positive impacts but also negative ones. As with all major cities in Indonesia, these negative impacts include the lack of vacant land in urban areas, increased pollution, flooding as a result of poor planning, socio-economic disparities, congestion, and the emergence of urban sprawl [1].

Based on previous research that analysed urban development in Makassar, the research focused on changes in physical characteristics [2]–[4]. Furthermore, at this time, there have been several studies that use space syntax to look at the interaction between space and movements and explore the effects of spatial configuration on human behaviour in Makassar city. Such as research that looks at changes in Makassar city space from several decades earlier [5], [6] and also research that looks at the influence of changes in settlement morphology and its impact on seaside settlements [7]. As a result, it is critical to analyse space not only from its physical elements, but also from the perspective of space and human interaction. However, if observed carefully, there is no research that examines the relationship between space and people in the new reclamation area of Center Point of Indonesia in Makassar City, which is currently planned until 2030 and is currently being built.

Humans are constantly influenced by their surroundings. Space consists of physical space and people that interact with each other [8]. There are many theories that have been developed to examine the relationship between space and people. One of the widely used theories is space syntax, which tries to clarify the social logic of space by using mathematical approaches and graphical analysis rather than just intuitive explanations [9]. This theory explains the interaction between physical space and socio-economic processes. There are two main propositions: the first is that space is not just the setting of human activities but the force behind them. Thus, each activity has a different spatial pattern [10]. And the second is to see space as a configuration. Configuration can be defined as a relationship that considers other relationships in a complex spatial network [11]. Thus, space syntax provides quantitative answers to the impact of the built environment and urban morphology on human behaviour in space [12].

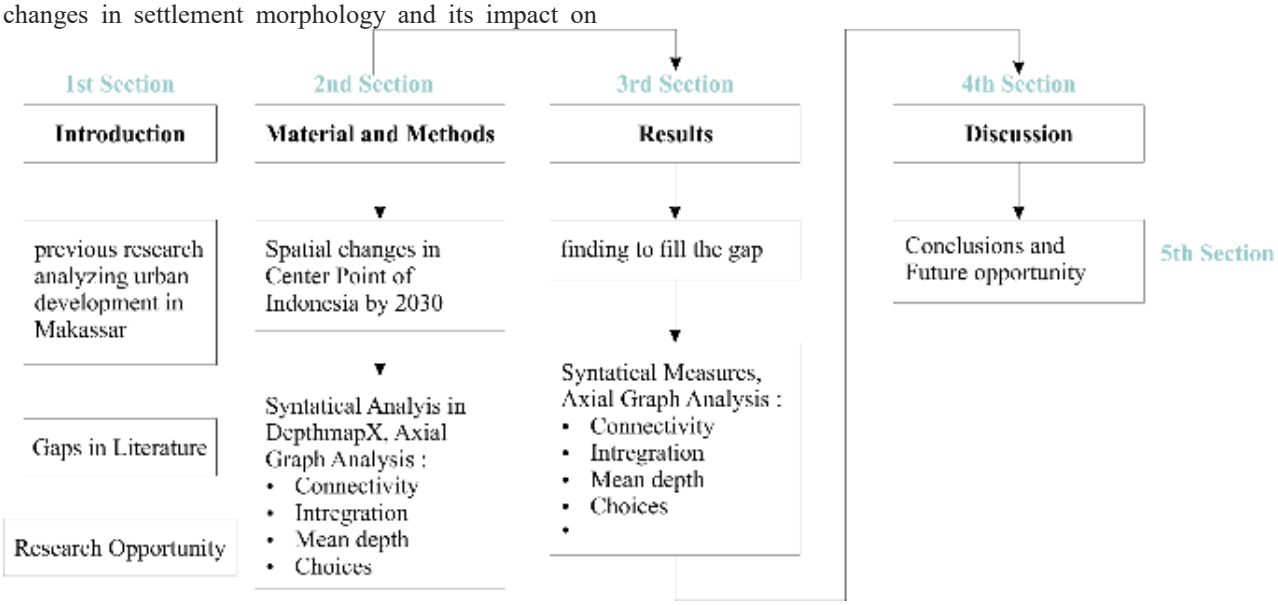

Figure 1 Research Plan

2 Material and Methods

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2.1 Study Area

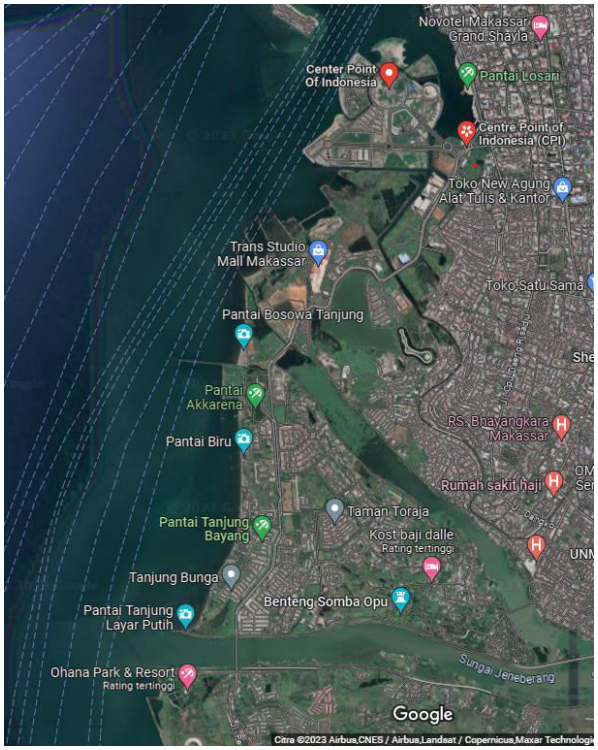

Figure 2 Center Point of Indonesia satellite imagery

The Center Point of Indonesia is currently still under construction, so the data owned is still in the form of a road network, and the other accessible data is still very limited. Moreover, the development progress is still in the area reclamation stage. For this study, we used data on the Center Point of Indonesia's road space and also Mariso District.

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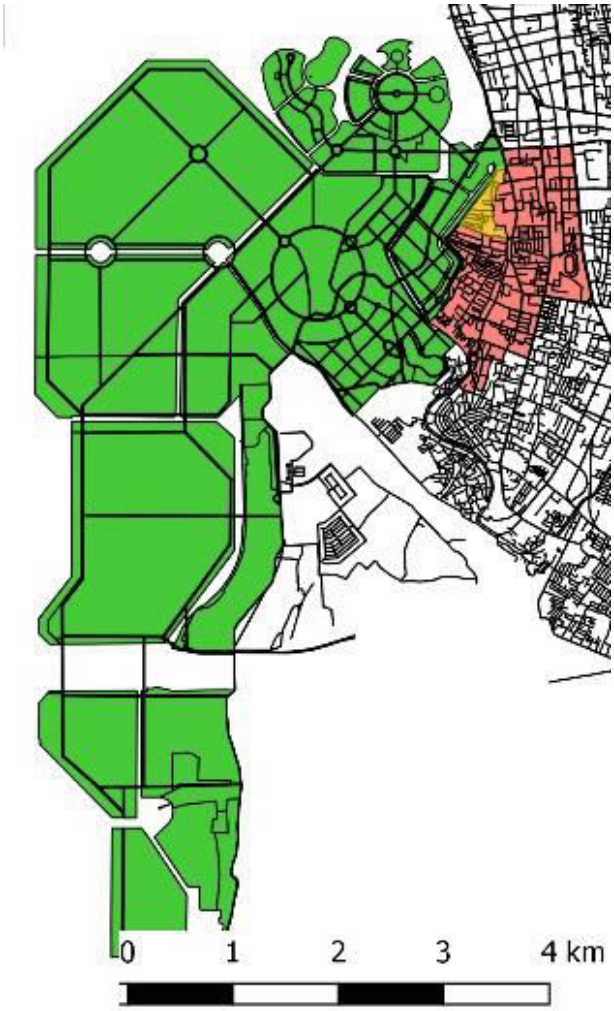

Figure 3 Center Point of Indonesia 2030 road network plan

2.2 Axial Graph Analysis

The syntactic analysis conducted in this study is in the form of axial graph analysis (AGA) to see integration and choice. AGA is currently considered the most relevant analysis technique to see movement patterns [13]. AGA is applied both locally and globally to see the possibility of movement and accessibility for both vehicles and pedestrians at different radii, allowing us to identify the integrity and potential accessibility of the entire area.

The process begins by using the Center Point of Indonesia 2030 road network plan data, which is converted into an axial line map and then processed using AutoCAD. The axial line map itself is the smallest and longest line in a space that can be accessed and allows movement and see what is in that space. [8] DepthmapX is a tool used to measure integration and choice. This research uses these syntactic measures to analyse natural movement patterns. The explanation of the syntactic measures is as follows:

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- Integration, is a description of natural movement patterns. In the global measurement (Rn), it shows how deep a space is to access from the whole space [8]. Integration is then categorised, starting with the most integrated and the most segregated. In the local measurement (Rn = 3), or what is commonly called local integration, n can be interpreted as a step up to 3.

- Choice, is used to measure the flow of movement patterns through space. The space with the highest choice is the space that can be accessed by the shortest path from all location points. This measurement is very useful to see the potential movement of vehicles and pedestrians[9].

3 Result

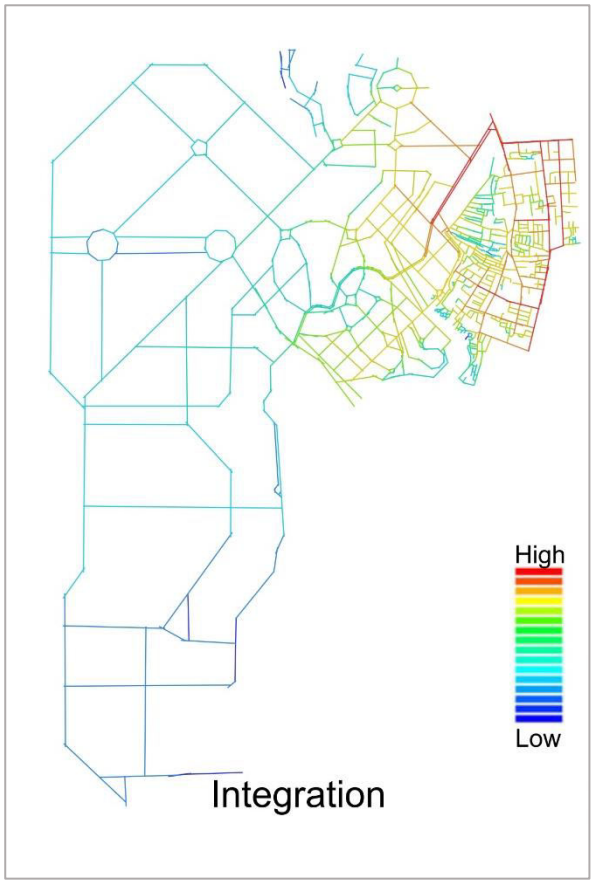

Figure 4 Axial analysis representation: integration of Mariso sub-district and the Center Point of Indonesia area globally (R=n)

Based on the results of global integration graph analysis (Rn = radius invinity) in Figure 3, the average integration value is 0.688417, the minimum integration value is 0.325882, and the maximum integration value is 0.997506. If we pay attention, the road sections that have a red colour are found on Cenderawasih St., Kakatua St., Hati Mulia St., and Hati Murni St., which are shopping areas and primary roads that have a fairly high width and movement. High integration values can also be found on Metro Tanjung Bunga St. and Rajawali St., which are located not far from the fishermen's residential area. This means that these roads have the lowest level of location and depth in relation to other spaces. Therefore, these roads can be categorised as the most integrated spaces in the spatial system.

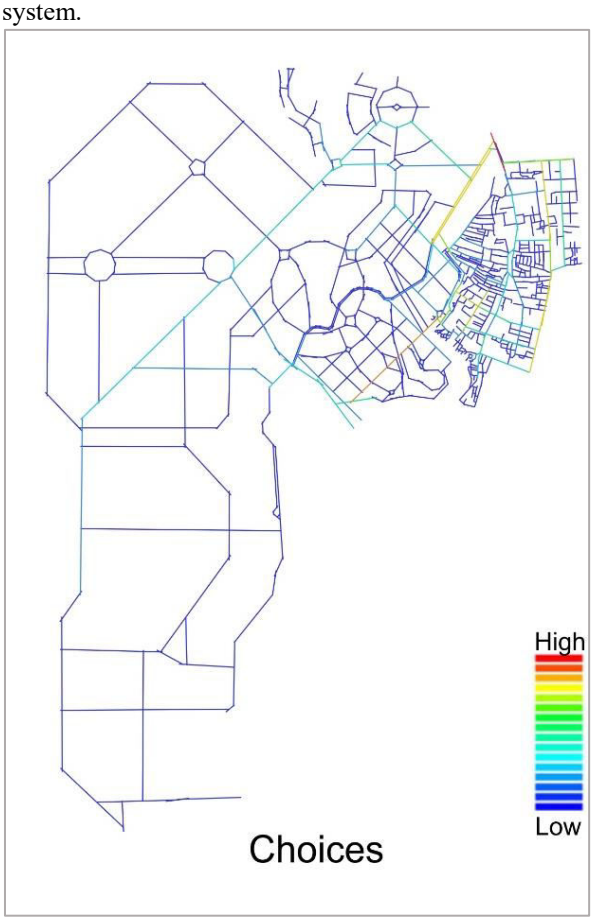

Figure 5 Axial analysis representation: choice of Mariso sub-district and Center Point of Indonesia area globally (R=n)

Based on the results of global choice graph analysis (Rn = radius of invincibility) in Figure 4, the average choice value is 10977.8, the minimum choice value is 0, and the maximum choice value is 199051. If we pay attention, the road section that has a high choice value is on Cenderawasih St., which is a shopping area and is a primary road that has a fairly wide and high movement. High-choice values can also be found on Metro Tanjung Bunga St., Penghibur St., and Haji Bau St. This is because these road sections are connecting lines between new areas and existing areas. This means these road sections have a high degree of choice and are located on the shortest path of all spaces in the system.

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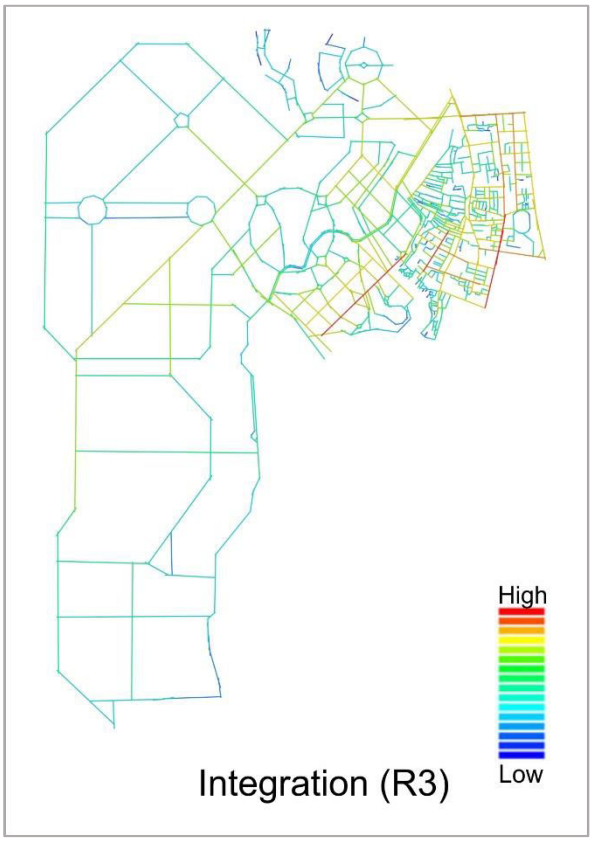

Figure 6 Axial analysis representation: integration of Mariso sub-district and the Center Point of Indonesia area locally (R = 3)

Based on the results of local integration graph analysis (Rn = radius 3) in Figure 5, the average R3 integration value is 1.46197, the minimum integration value is 0.3333, and the maximum integration value is 3.31695. If we pay attention, the road section that has a red colour is on Cenderawasih St., which is a shopping area and is a primary road that has a fairly wide and high movement. Unlike the global measurement, the green open space area of Maccini Sombala Park looks to have a high level of local integration, which indicates that this area is easily accessible to pedestrians.

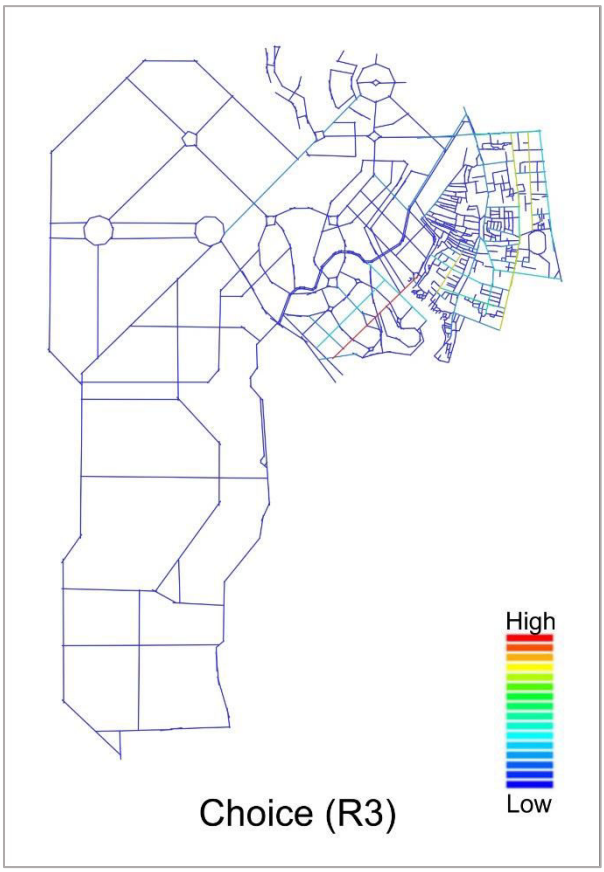

Figure 7 Axial analysis representation: choice of Mariso sub-district and Center Point of Indonesia area locally (R = 3)

Based on the results of local Integration graph analysis (Rn = radius 3) in Figure 5, the average choice R3 value is 35.2675, the minimum choice R3 value is 0, and the maximum choice R3 value is 1191. If we pay attention, the road sections that have a red colour are in the green open space area, Maccini Sombala Park, which makes this area have the highest level of choice in the space system. This is in line with the results of the R3 integration analysis conducted previously. It can be said that at the local level, this area is the most accessible for pedestrians.

Table 1 Attribute Summary

	Atribute	**Minimum**	**Average**	**Maximum**
	Global (Rn)			
1	Integration	0.352882	0.688417	0.997506
2	Choice	0	0.022791	0.413251
	Local (R3)			
3	Integration	0.333333	1.46197	3.31695
4	Choice	0	35.2675	1191

4 Discussion

From the results of the analysis that has been carried out, we can see that in the global measurement of integration (Rn), Cenderawasih Road, Kakatua Road, Hati Mulia Road, and Hati Murni Road are the roads

that have the highest integration in the spatial configuration system. This is in line with the fact that these roads are the main roads that connect one area to another. In fact, on these roads, there is also often a buildup of vehicles that causes congestion on the road. This is also enough to illustrate that the space syntax is sufficient to predict what happens in the real world.

In the measurement of global choice (Rn), we can see that the Penghibur road shows the reddest colour, which shows that this road has the highest level of global choice. This can be explained by the fact that the Penghibur Road has a dependent path to be accessed from all spaces in the system.

In the local integration measurement (R3), the green open space area, Maccini Sombala Park, is the area with the highest integration and choice R3 values. This is in line with the fact that the area is an area that is often visited by the surrounding population to exercise, just walk, or cycling. Cenderawsih Road also again shows a high integration value, which means that in addition to being a road that connects one area with another, this road is also a shopping area, and there is also the Mattoangin Sports Stadium, which is a place for local residents to exercise.

Then, in the measurement of local choice (R3), it can be seen that the results of the analysis show that the Green open space area, Maccini Sombala Park, is the area with the highest local choice, which indicates that this open park is located on the shortest path of all spaces in the system, while Cenderawasih Road also shows a fairly high level of choice.

Furthermore, in the Center Point of Indonesia area itself, we can see that this area does not have a high level of integration and choice, both globally and locally. Especially considering that this area can only be accessed through the Tanjung Bunga Metro Road, this is in accordance with the city government's plan, which, if we look at this area, is planned to be private and not fully open to the public.

In the end, the results of the analysis that has been carried out show that the syntactic measurements carried out in this study have no difference from the actual situation. So it can be said that the "socio logic of space" theory can be used to predict natural movement that occurs in the real world. This study is just a first step and still has many shortcomings. It has not examined other aspects that can certainly further enrich the results of this research. Research using space syntax by considering the conservation of heritage areas that are not far from the Center Point of Indonesia is certainly an opportunity. Like the research by Hegazi (2022), who introduced 'Socio Spatial Vulnerability" to help overcome vulnerable configuration characteristics that increase negative spatial behaviour[14], [15].

5 Conclusion

Metro Tanjung Bunga St. and Cenderawasih St., with the highest integration and choice values both globally and locally, indicate that these roads are the most accessible roads of all parts of the space configuration. Although it is only an analysis and needs further research, the results of this space syntax measurement are considered to represent what is happening in the actual situation.

Ultimately, this initial study further demonstrates that the *socio logic of space* theory can be used to understand natural movement" at the urban level. The results of the analysis carried out are not much different from the conditions that occur in the real world. This shows that space syntax can help us analyse natural movement.

6 Acknowledgement

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