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Space Syntax Analysis On Level Of Security and Privacy Of Road Space. Case Study: Campus Area Of UGM, Yogyakarta

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ABSTRACT

The road space is not solely reserved for the public interest. In some examples can also be used exclusively for the residents of a region that have been designed from the beginning or through some post-occupancy adjustments. In the case of the campus of Gadjah Mada University (UGM) area, there are road spaces that become public facilities that pushing the campus authority to create access modifications (by closing or fencing) for the security and/or privacy purposes. How much the level of security and privacy that is obtained, in this paper were analyzed using space syntax. Through its ability to analyze the quality of space connectedness, space syntax can be used to measure the level of security and privacy refers to a benchmark proposed by Reis (2003) [1] uses the value of the integration space. Integration of road space that is worth the low/weak (RA and RRA = 1 or more) has a low level of security but more private. While the high-value/strong integration (RA close to 0 and RRA = 0.4 to 0.6) have a high level of security but less privacy. Through the obtained analysis; a large enough degree of privacy is achieved, especially in the area of Central Office/Rectorate Building and surrounding areas, however, it become unsafe due to the activity-deserted road space situation and lack of supervision.

Keywords: *Road space, Security, Privacy, Space Syntax, Space integration*

1. Introduction

The campus of Universitas Gadjah Mada (UGM) is an integrated campus area located in the north of the city center of Yogyakarta. The campus area bordered to the south by Jalan (road of) Prof. Dr. Sardjito and Jalan Colombo, east by Jalan Prof. Dr. Notonagoro and Lembah Karang Malang (also neighboring with another campus, Universitas Negeri Yogyakarta). While in the west bordered by extension of Jalan Prof. Dr. Sardjito and Jalan Kesehatan (where there is a hospital of Prof. Dr. Sardjito and a small river of Code), and to the north is bordered by Jalan Teknika, Jalan Argo and Jalan Bougenvile (old gutter of Mataram).

The campus area of UGM is not exclusively accessed only for the UGM community. This area divided by a four-kilometer of Jalan Kaliurang, which also becomes a public road for residents of the city of Yogyakarta. Some of the roads that become boundaries of the campus area are also public roads such as the Jalan Kesehatan, although there are Faculty of Engineering complexes on the west side of the area. There is also Jalan Teknika and Jalan Argo (Mataram Sewer) although there is still a Postgraduate School complex, PAU Building, and MM UGM campus. Meanwhile on Jalan Notonegoro to the Jalan Olahraga is also generally used by residents, although in the east there is still a part of the UGM complex, namely sports facilities and Madya stadium.

As seen in the road network planning, several roads within the UGM campus complex are directly connected to these public roads. In several considerations, some of these roads are restricted in access to maintain the needs of privacy of buildings/facilities on the UGM campus, such as the UGM Head Office, Grha Saba Pramana Building and several faculty buildings.

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The road network which has many choices of access certainly has a strategic position for its users. Such a road network has strong integration as well as being the choice of users to be accessed from the place of origin to their destination. On the other hand, the more strategic the existence of a road can affect the level of security and privacy of the surrounding area. How then the level of security and privacy of an area observed from the existence of the road access will be analyzed in this paper using the space syntax method. Whether the road's closure/fencing policy in order to restrict access as mentioned earlier is the right decision if it is matched to the reference theory used in this paper.

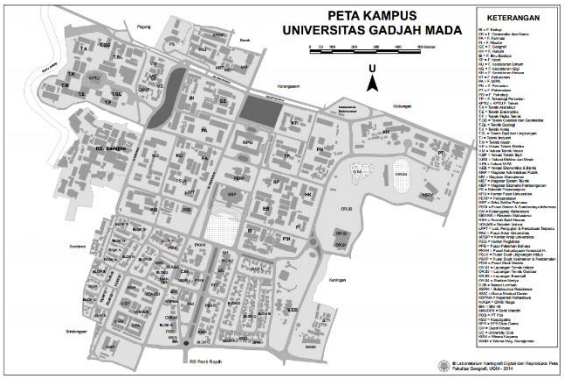

Figure 1: Map of UGM Yogyakarta area.
Source: Laboratorium of Cartography, Faculty of Geography, UGM, 2014

2. METHOOLOGY

2.1. Security and Privacy

Referring to a journal article titled; Accessibility and security: Syntactic and perceptual analysis in two low-income housing estates by Antonio Reis [1] citing a statement from Gehl (1987); accessibility and potential movement and presence of public spaces/road users (presence of people) in urban areas can impact on the choice of road access that commonly chosen by road users. People or road users will be interested in the space in which there is another person's presence, and avoid deserted spaces.

Related to the level of security and privacy; the choice of a road access can affect the condition of its surrounding area whether it to be safe, controlled and more privatized, or vice versa. The more roads are chosen/used as a public roads (in the sense that they are more strategic and more crowded), the more surrounding area will be alive with various activities that arise. Conversely, if a road is not the main choice of access, it can have an impact on the less vital the surrounding area. The level of security is seen relatively, based on the point of view of what 'security' is meant. The more crowded or even more emptier an area can affect the level of security.

Reis [1] uses the perception that the more integrated a road is, the more secure the road can be, because things related to security disturbances are more avoidable because supervision between individuals is more likely to occur. Meanwhile, if a road is not integrated with other road networks, it will be vulnerable to low security conditions. Roads that tend to be segregated in the context of their connection to the road network as a whole are usually under-monitored, so that criminal acts or other security disturbances are more likely to happen.

In the context of privacy, the level of privacy can be achieved depending on whether the road conditions are more commonly used or restricted. Public roads usually have a low level of privacy. If the access road is increasingly limited/restricted (for example, there are gates, fences or security posts), the surrounding area will have a high level of privacy.

Table 1. The Level Of Security and Privacy Of A Road As Seen From The Level Of Road Integration

	Level of Security		Level of Privacy	
Low/Weak Integration	•*The road is not an option to be accessed* •*Lack of supervision*	**Low**	•*Emptier road spaces* •*Less movement*	***High/Private***
High/Strong Integration	•*The road is more strategic* •*More supervision*	**High**	•*Denser road spaces* •*Lots of movement*	**Low/*Public***

2.2. Space Syntax

Space syntax is a tools for research prepared for help thinking in paradigm of built environment morphology. The explanation written by Darjosanjoto [2] (p.6) in her book;

"Architectural Research in the Field of Housing and Settlements", based on the statements of Hillier and Hanson which became the initiators of space syntax. Then Darjosanjoto cites that the purpose of this space syntax program is to develop a theoretical understanding about how space working spatialy by simple visual statistic.

In the space syntax discourse, Darjosanjoto introduced several applicable terminologies, namely the term "syntax" (syntax) refers to building spatial structure. Within the scope of a residentials, 'syntax' discusses the arrangement of space (for a single house building) and the arrangement of houses for a residence that forms a cluster of buildings. The two terminologies are based on references from Hillier and Hanson leading to an explanation of the term 'space syntax' which is defined as a technique/method to display, estimate or calculate or measure the configuration of space in a building, as well as how to analyze and interpret it (in this case is the configuration of the road space in the area).

The level of integration delivered by Reis previously was part of the syntactic calculation of space. The value of integration (also called integrity) can be interpreted as a hypothetical value for the convenience of someone to reach a space from each other space. High integrity value (low depth / depth) means that space can be easily achieved from every other space while low integrity value (high depth / depth) means that space cannot be reached easily because the observer must pass through several spaces between the above first. Further integrity is used to study the compactness of space in a space system. Space with high integrity values can be interpreted as a space that has a high degree of unity towards overall space configuration (global), and vice versa, spaces with low integrity values will tend to separate themselves in configuration [3] (p.7).

Calculation of the level of integration of a space configuration can be done with computer Depthmap application. This application accepts input in the form of space mapping images so that axial lines can be determined to represent the quality of the space in the context of accessibility, visibility and connectedness between spaces. These contexts determine the integration value of the spaces analyzed by Depthmap.

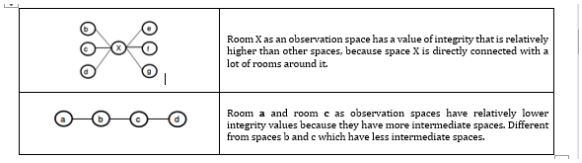

Figure 2. A simple scheme about the concept of space integration.
Source: [3]

Calculation phase→	Total Dept (TD) →	Mean Depth (MD) →	Relative Asymmetry (RA) →	Real Relative Asymmetry (RRA)
Explanation:	TD is calculated by adding up the *step depth* of the entire space to the observation room.	MD calculation is to get an average depth of a space. The results are used in the next step formula	RA is useful for comparing the *axial map* depth of a particular space against the depth and superficiality of the space. RA generate value of 0 – 1. The smaller the value indicates the higher integrity. The values only can applied to one space system analyzed.	RRAS is a standardized RA value if we want to get an integrity value that can be compared with other spatial configurations. A low RRA value means that the space has high integrity in the configuration of the space. RRA calculations require standardized RA values (GL)

Figure 3. The phase of calculating the value of space integration in space syntax.
Source: Hillier dan Hanson: 1984, Teklenburgh et al: 1993, in [3]:p.7-8

2.3. Methodology

2.3.1. Benchmark of Integration Level

Based on Reis [1] the following parameters can be a criterion in determining the status of security and privacy of a road through space syntax analysis. These parameters include:

1. Relative Asymmetry (RA) values close to 0 (zero) indicate the theoretically most integrated road network. The more integrated road network (RA = 0), the more people choose to use it as a movement path.
2. Low Relative Real Asymmetry (RRA) value indicates the existing road network has high integrity, similar to RA assessment. But Reis more specifically describes the values that can be used as

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benchmarks in this level of integrity, among others is the value of 0.4 to 0.6 which represents a very high level of integrity that is commonly found in road network systems. While values above 1 have weak integration (road networks tend to be segregated).

2.3.2. Network Mapping

As mentioned in the introduction, the case study observed was a road network in the UGM Yogyakarta campus area. Road network is redrawn using CAD tracing referring to the basic map in the form of a google map image. UGM complex road network is described in two conditions; (1) Conditions when the entire road network is accessible (no closure or fencing); and (2) Conditions when access restrictions are applied (with a closure or fencing).

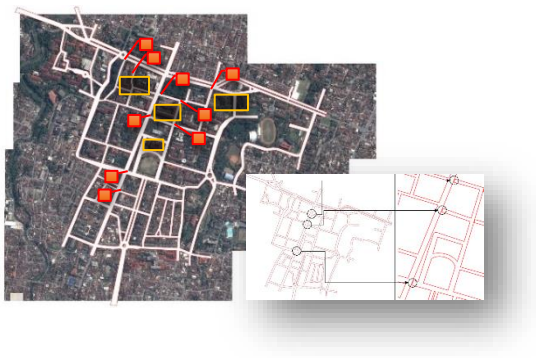


Figure 3. CAD-tracing from map image of Google Earth and its modification drawing the road closure/fencing locations

The two conditions mentioned above need to be described to compare the level of integration between open-access conditions and restricted access. In the existing road network at the UGM campus area, the roads that involved in closing/fencing include:

a. Road in the Faculty of Biology complex (Figure 3, box numbers 1 and 2).

b. Roads in the area of rectorat office to the campus hall of Grha Saba Pramana (Figure 3, box numbers 3-8).

c. Roads in the Faculty of Forestry complex (Figure 3, box number 9).

3. ANALYSIS AND DISCUSSION

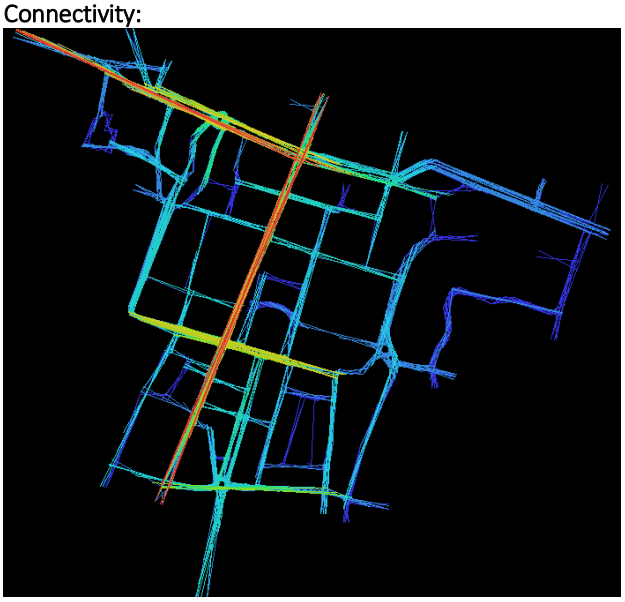
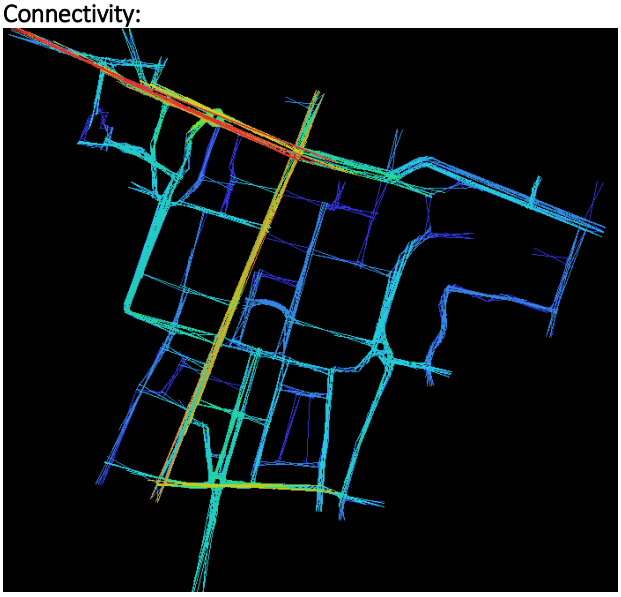
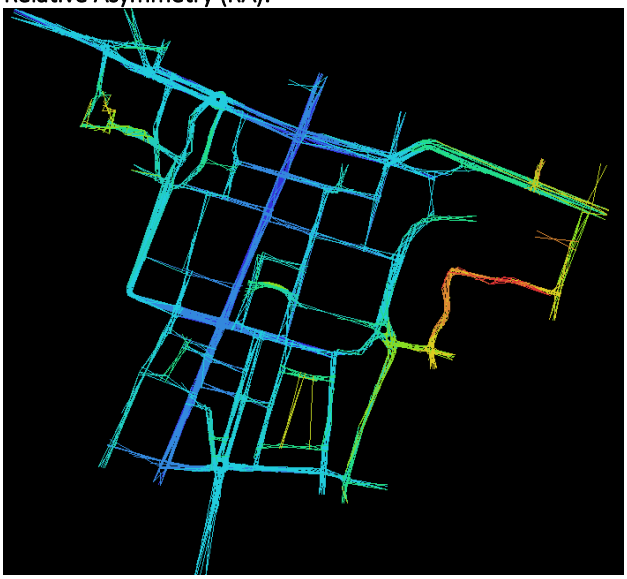
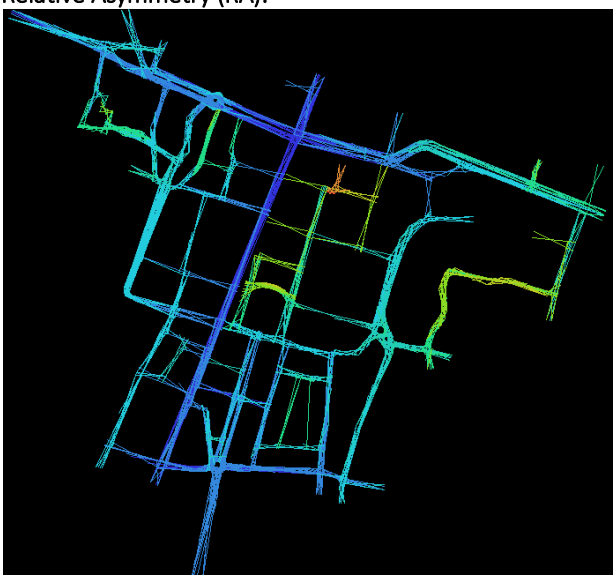
From the results of the general analysis, the normal road network in the UGM campus area compared to the conditions when the road closure is applied as illustrated in figure 3 shows that; Road with closure indicate a more segregated network system due to higher RA and RRA values (RA = 0.071 and RRAS = 0.825), while if the road closure is not applied shows more integrated conditions (RA = 0.060 and RRAS = 0.705) which means road networks are more accessible to the public. The condition of the road closure which in turn restricts the public from accessing the UGM campus area creating privacy areas around the road closure. This is consistent with the theory of Reis [1] which states that; *"…high level of segregation… tend to reinforce the movement and control by the resident in detriment of the movement and control by the visitor"*.

Table 3. Depthmap Analysis

Depthmap analysis on the normal road network in Campus of UGM area.	*Depthmap analysis on the restricted conditions of the road network in Campus of UGM Area.*
Summary:	Summary:

Attribute	Minimum	Average	Maximum
Connectivity	2	5.02128	17
Integration [HH]	0.83592	1.55251	2.92248
Line Length	841.245	6633.1	31559.4
Mean Depth	2.3871	3.7671	5.84946
RA	0.0301543	0.0601544	0.105423
Step Depth	0	2.3617	6

Attribute	Minimum	Average	Maximum
Connectivity	1	4.70968	16
Integration [HH]	0.721544	1.30679	2.36685
Line Length	898.728	6538.05	31559.4
Mean Depth	2.70652	4.27115	6.59783
RA	0.037506	0.0718935	0.123029
Step Depth	0	2.66667	6

Depthmap analysis on the normal road network in Campus of UGM area.	*Depthmap analysis on the restricted conditions of the road network in Campus of UGM Area.*
Connectivity: 	Connectivity: 
Relative Asymmetry (RA): 	Relative Asymmetry (RA): 
Integration:	Integration:

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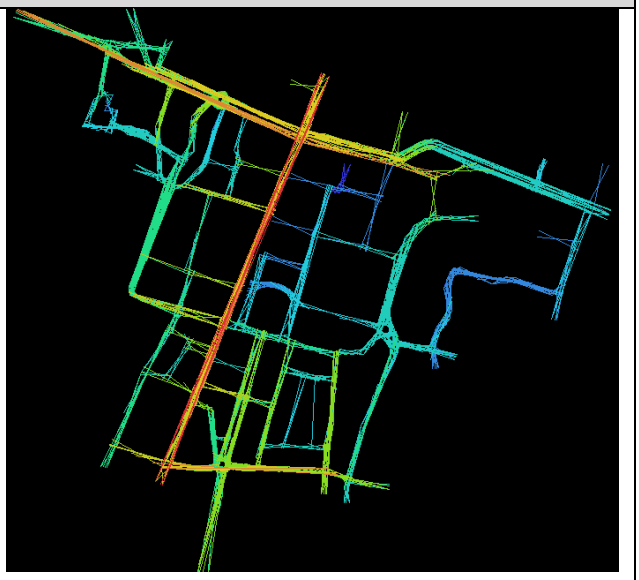
Depthmap analysis on the normal road network in Campus of UGM area.	*Depthmap analysis on the restricted conditions of the road network in Campus of UGM Area.*
	
Calculation of RA and RRA:	
Normal road network: Mean depth = 3,77 RA = 0,060 RRA = RA/GL = 0,060 / 0,085 = 0,705	*Road network with closure/fencing:* Mean depth = 4,27 RA = 0,071 RRA = RA/GL = 0,071 / 0,086 = 0,825
GL is standardized RA to determine RRA, obtained through calculation formula: $GL = 2\,\frac{L(L)^{\frac{1}{2}}-2L+1}{(L-1)(L-2)}$	

In more detail to see the difference between the two road conditions above, the following is the calculation result of each road affected in the closure/fencing:

Table 4 Detailed values from roads that affected by the closure/fencing

	Normal road network			**Closed/fenced road network**		
Road code by number	Axial line ref. code no.	RA	Step Depth	Axial line ref. code no.	RA	Step Depth
1	62	0,055	2	-	-	-
2	58	0,056	2	55	0,074	2
3	34	0,043	1	-	-	-
4	18	0,042	1	-	-	-
5	35	0,035	1	34	0,070	3
6	56	0,050	1	-	-	-
7	34	0,043	1	29	0,123	6
8	18	0,043	1	20	0,080	4
9	24	0,049	2	30	0,101	5

From the table above shows that the closure/fencing of the road in the nine roads caused several tendencies, including:

1. Axial lines are not drawn by Depthmap, ie on roads numbers 1, 3, 4, and 6. This indicates that road spaces are not considered vital or those are dead space.

   Looking at the existing conditions, roads number 1 is the road to the west of the Faculty of Biology complex that separates the Faculty to the city park/built-forest. Roads number 3 and 4 are roads that flank the north and south of the UGM head office or rector's building, and roads number 6 are roads that should connect the Jalan Kaliurang with Jalan Boulevard in the south of Grha Saba Pramana (the campus hall).

   The condition of the roads tends to be quiet/empty from public activities, there is no vehicle movement and there is only minimal pedestrian activity. In this area, privacy is quite achieved and in the context of security, the road is not directly supervised.

2. The RA value changes to be greater which indicates the road has been segregated after closing/fencing. The most significant segregation is roads number 7 and 9. This trend is also confirmed by the large value of step depth.

   Roads number 7 and 9 are roads that cross through the Faculty of Forestry complex, in contrast to roads that are not axially readable, they still show movement activities even though they have to be reached at considerable depth (a winding road to access).

4. CONCLUSION

Several roads within the campus of the Universitas Gadjah Mada (UGM) area that conditioned to be restricted access is aimed at maintaining privacy and security, considering that the campus area is also a public crossing in the overall city road network. A large level of privacy is achieved, especially in the head office/rectorate building area and its surroundings, even though this area is directly adjacent to the Jalan Kaliurang which is the main road for public access. The level of security is a relative judgment in this case, depending on the variable used. In this paper under Reis theory; road network that is not an option of access (in this case closed/fenced road); movement/circulation is minimal, and lack of activity causing a lack of supervision causing the road to becoming unsafe.

With a high level of privacy some roads that are closed inside the UGM campus complex become less safe because of the lack of activity (quiet/emptier roads) so that even though privacy is achieved to obtain the adequate quality of security, good supervision must be applied to these roads.

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