Social Logic of Cities and Urban Tourism Accessibility; Space Syntax Analysis of Kuala Lumpur City Centre

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Abstract

Tourism is a progressively major part of economies of urban areas. Urban regeneration as a subcategory of urban tourism has been the center of many urban projects. This study addresses the role of space syntax theory as an analytical tool and design aided tool in urban regeneration. For this purpose, we examined the development of a square in the Kuala Lumpur City Center (KLCC) using space syntax method. Surrounding streets network one time with existed situation and another time with adding proposed square were analyzed by Depthmap software and were compared. Numerical analysis showed a significant increase of integration of the most number of streets. Based on the connection of integration and other concepts of space syntax in accessibility and people flow the proposed square can be a major contribution to accessibility problems of tourists in KLCC. It can be seen that the synergy of the streets that link Jalan Ampang is increased; moreover, intelligibility and accessibly may well be improved in this area by the suggested square. The behavior of tourists and local people based on wayfinding can be developed by new spatial configurations.

Keywords: Urban tourism; Space syntax, City configuration; Square; Accessibility; Kuala Lumpur city centre.

1. Introduction

The research about urban tourism and related elements to urban tourist realm is a growing field of study (Ashworth & Page, 2011; Miller, Merrilees, & Coghlan, 2015). policy makers, researchers and practitioners try to have better understanding of tourism within urban areas(Edwards, Griffin, & Hayllar, 2008). Urban tourism has appeared as a distinctive and major area of research during the 90s. Earlier studies dating back to the 60s were limited in scope(Pearce, 2001). It has played a role as one of the significant functions of the cities (Lapko, 2014).

City centers have traditionally attractions for both international and local visitors. Urban areas provide a series of tourism and travel related attractions that are varied in nature but highly focused in location. City centers offer exceptional chance for visitors whose main purpose is meeting other people or institutions .Their purpose of visit might be different for business or leisure or personal (Vandermey, 1984). Because of high potential of urban tourism for connecting people, mixed cultures and experiences with place and consumption, it creates an exciting and excellent exploration for visitors (Edwards, Griffin, & Hayllar, 2008).

The study is about the relationship between urban tourism and urban morphology originated in Britain as resort morphology (Gilbert, 1949). Ashworth (1989) suggested four approaches to consider urban tourism. First, facility approach for spatial analysis of the places of tourist attractions, infrastructure and facilities, second, the ecological approach for analyzing the morphology or structure cities, third is user approach and forth is policy approach. The two first approaches are related to structure and morphology of city. Gospodini (2001) has examined how urban morphology including spatial and formal patterns may effect on urban tourism. She argues that while some certain spatial aspects of the urban tourism including urban planning issues and urban management issues have been already well documented, So far there is a lack of literature concerning relationship between urban tourism and the spatial and formal dimensions of the urban environment—urban space morphology. This lack of study can be considered after 2001 until recent studies.

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2. Research Background

Since the mid-1980s, tourism has become a progressively major part of economies of some urban areas. Tourist developments, for instance are repeatedly at the centre of main projects of urban regeneration (Hall, 2009). Owen (1990) with the analyzing of five examples (the restoration of Rouen‘s medieval heart; the restoration of war damaged Valletta; South Street Seaport, a new tourist attraction in downtown New York; and Rotterdam) argues about the role of tourism in the regeneration of urban areas. He pinpoints that tourism can be a facilitator for fundamental changes in the moral, economy and appearance of urban areas in transition. Regeneration of cities has been considered among tourism researchers (Karski, 1990). According to Ashworth and Page (2011) one of the main sub-themes of 12 sub themes of urban tourism research is urban regeneration.

Beside the importance of city morphology in urban tourism (Gospodini, 2001) the wayfinding and accessibility for tourists in city are significant factors for

urban tourism (Safari & FakouriMoridani, 2017). Toth and David (2010) called the accessibility as a key element for tourist in city. In other hand, the studies related to accessible urban tourism(Darcy & Dickson, 2009; Hano, 2011; Touth & David, 2010; Wieckowski et al., 2014) have focused mostly on transportation accessibility and accessibility for disabled , elderly and children in cities from touristic perspective. Wayfinding is another key element for visitors of urban areas.

Wayfinding is purposeful movement to a specific destination (Golledge, 1999). Humans use two strategies in wayfinding: Euclidian metrics as direction and distance estimates associated with cognitive map (Golledge, 1999; Kitchin & Freundschuh, 2000; Safari, 2016a) and use landmark strategy (Rurgess, 2006). Xia, Arrowsmith, Jackson, & Cartwright (2008) Highlights those tourists apply different methods for wayfinding and tourist managers should offer complementary materials to help them in wayfinding.

In search for an appropriate urban theory to help urban tourism and urban regeneration for assisting the tourists in urban areas, we may consider different theories of urban researchers in twentieth century. The desired theory for this purpose should have significant role in urban design and regeneration.

After the proposal of the theory of the analytical method theory by (Collins, & Sitte, 2006; Sitte, 1945) and (Geddes & Library, 2008; Welter & Whyte, 2003) in the second half of the twentieth century, the analytical method is commonly used in urban design. Urban designers desire to apply quantitative methods to urban models. There is a broad series of these approaches such as M.R.G. Conzen as an analytical urban geographer (Conzen & Conzen, 2004); Kevin Lynch as an analytical researcher with the city based on the perception of main urban components—paths, edges, districts, nodes, and landmarks (Lynch, 1960); and Alexander (1968) who analysed the urban grid, developing a regular and rather systematic opinion about urban design. In the 1960s, the structured method was at the centre of the design debate, which was continued by theorists in the 1970s such as Rittel (1972).

Karimi (2012) with a review of aforementioned methods and some recent methods, such as transport models (Lee & Boyce, 2004) economic models(Fujita, Krugman, & Venables, 2001) and planning models (Hall & Tewdwr-Jones, 2010) emphasize on the direct role of space syntax in design process. Also he believes that the huge amount of resources, data and time that are needed to run and create the models in other methods make their usage in design less practical.

Also Weber and Landis (2012) noted that many methods are not linked to a range of scales, such as regional, district, neighbourhood, or public space scales. Moreover, analytical models that could deal with large urban systems, such as transport models, are typically data-intensive, time consuming and rather expensive.

Space Syntax is a methodology that proposes a configurationally, analytical framework for urban design. Space syntax can connect the urban space with people's behaviour. Furthermore space syntax attitude can deal with a range of scale from local to global (e.g., an urban room, an entire city, a whole region). Eventually, space syntax is able to consider whole parts of space (Karimi, 2012). Space syntax can then be applied as an analytical methodology for the urban design process, and researchers believe that space syntax connects space and society and consists of procedures to analyse spatial configurations (B. Hillier & Hanson, 1998; B. Hillier, Hanson, Peponis, Hudson, & Burdett, 1983). Studies have shown that configuration affects people and their behaviour as they move through the city (B. Hillier & Penn, 1996; B. Hillier, A. Penn, J. Hanson, T. Grajewski, & J. Xu, 1993) such as a cognitive map and wayfinding (Conroy-Dalton, 2003). Connecting urban spaces with people's behaviour and considering wayfinding and accessibility issues in space syntax theory are factors that we can candidate it as an appropriate tool to contribute in urban tourism accessibility. Meanwhile in spaces with high integration tend to have relatively higher use-densities by individuals (Bill Hillier, Alan Penn, Julienne Hanson, Tadeusz Grajewski, & Jianming Xu, 1993). This relationship tested and found correct also in the case of tourists—a special category of users (A. A. a. L. Gospodini, PH., 1998). This high use-density of space especially in public open spaces generates a lively atmosphere mostly appreciated by tourists (A. Gospodini, 2001). Error! Reference source not found. shows the relationships between urban tourism and space syntax concepts.

The aim of this study is examining the role of space syntax theory as analytical and design aided tool in improving accessibility and wayfinding of tourists in KLCC by proposing a square.

3. Space Syntax: the Social logic of Space

Space Syntax was first applied by Bill Hillier and Julienne Hanson (B. Hillier & J. Hanson, 1984) to analyse configurations of urban space. The idea of space syntax is that manmade societies utilize space as a crucial and essential source for organizing themselves. The configuration of space term in space syntax is recognized as converting the continuous space to a linked set of separate units. Turning the space into a separate configuration is beneficial due to various labels can be used to its discrete parts. These parts then can be allocated to diverse people, groups, or activities; various patterns of behavior and separate parts of space can be distinguished as carrying a special cultural or symbolic charge (Bafna, 2003). Analysing spatial configuration is a beneficial application of space syntax, which evaluates the behaviour of people in unfamiliar environments (Haciomeroglu, Laycock, & Day, 2007).

This type of view would naturally suggest that the configured space lets a social structure to be mapped onto itself. However Space syntax theory, rejects this simple "space-as-form" and "society-as-content" distinction (B. Hillier & J. Hanson, 1984). Relatively, the core premise of the space syntax theory is that the social structure is naturally spatial and inversely that the configuration of

space has a social logic (Bafna, 2003) as Bill Hillier and Julienne Hanson (1984) describes the idea in his well-known book titled “social logic of space”.
Space and society have a relationship by way of intrinsic correspondence between spatial conditions and human behaviour. This principle has a strong effect in design with space syntax. Space syntax considers spatial configuration and human behaviour together; it is a very useful and practical method for designing and shaping while considering function. According to this theory, there is series of illustrations that have been developed to analyse existing spatial and proposed spatial configuration. These figures are mainly based on essential concepts such as visual perception, movement, and human activity. These illustrations show simple geometrical attributes (e.g., lines mean movement, visual fields make a network). It can also be analysed quantitatively to identify the relationship between spatial configuration and human behaviour. (Figures 8, 11, 12, 13) (Karimi, 2012).
In Space Syntax, accessibility is defined by integration, which is determined as nearness centrality from origin to destination. This calculation shows times of pedestrian flow where higher accessibility is correlated to higher pedestrian flows, and lower accessibility is correlated to lower pedestrian flows (LAW, CHIARADIA, & SCHWANDER, 2012). In addition, space syntax can illustrate separately the geometric properties of networks. The geometric continuity of the grid can then be calculated (LAW et al., 2012).
In theory, the space syntax method states that spatial configuration is mainly affected in the context of urban space, as in pedestrians’ behaviours for example, when moving from origin to destination in the shortest and most direct route (B. Hillier, 1996; B Hillier, Penn, Hanson, Grajewski, & Xu, 1992). Axial line analysis of space syntax illustrates the accessibility of urban space. This software result was created by computer simulation to measure the distribution and movement flow in urban space (Buchanan, 1965; Hill, 1984). Axial map analysis explains the behaviour of people in a pattern of urban spaces. This method uses computer simulation to illustrate social urban space analysis and treatment of people together (B. Hillier & J. Hanson, 1984; B Hillier et al., 1992).

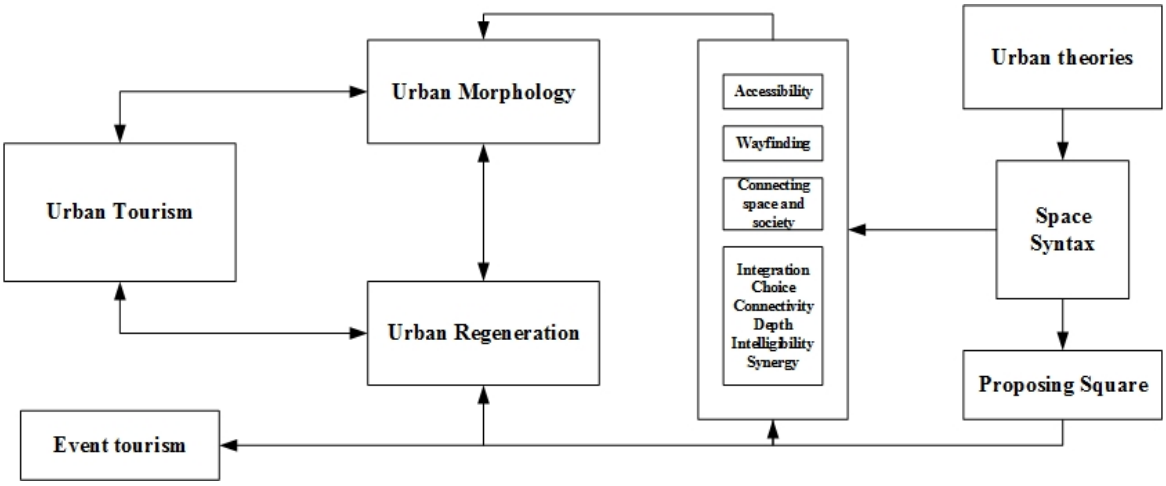

Fig. 1. The relationships between urban tourism and space syntax concept (Source: Authors)

3.1 Concepts and methods of space syntax analysis

Three basic concepts of Space Syntax Analysis are defined as below:(Klarqvist, 1993)
Convex space is a space that there is no any cross between border and connected line of any two of its points. A concave space must be divided to the least possible number of convex spaces. *Axial space or an axial line* is a straight line (sight line) can be followed on foot. *Isovist space* is the whole area that can be seen from a point.
Three types of syntactic maps including *convex map*, *axial map* and *Isovist map* can represent the spatial structure of a layout. An axial map is an important analytical method for analysis of urban space research. It represents the longest lines of vision and movement. It is shown as a model that makes an uncomplicated graph of the spatial space. It is correctly simulated by perception and navigated through by people. There is a correspondence that shows a relationship between space configuration and people's behaviours. Analysis in this method, considering space configuration and people's behaviours, serves an urban design process (Karimi, 2012).
In space syntax theory the four most popular ways of analysing a street network are Integration, Choice and Depth and connectivity.
Integration shows how many turns have to be made from an origin to reach all other destination in the city, using shortest routes. If the number of turns required for reaching all destinations in the graph is analysed by simulation software, the analysis is supposed to global integration (Rn). The routes that require the fewest turns to reach all other destinations are called 'high integrated'. Integration can also be analysed in local scale (R2 or R3) instead of the scale of the global (B. Hillier & J. Hanson, 1984).
Connectivity means the number of streets that are connected to a specific street. Moreover, the streets with the highest total values of accumulated flow are said to

have the highest choice values (Haciomeroglu et al., 2007).
Depth is stated as the number of steps to reach all other nodes from node *i* in the space syntax graph. The mean depth map *i* is illustrated in Equation 1.

$$\text{Mdepth}_i = \frac{\sum_{k=1}^{n} \text{depth}_{i,k}}{n-1} \quad (1)$$

Where *n* = number of nodes in the space syntax graph, depth *i*, *k* = the shortest depth from *i* to *k.*
The integration value is defined, as an inverse measure of Mdepth $_i$ illustrated in Equation 2.

$$R_i = \frac{1}{\text{Mdepth}_i} \quad (2)$$

Choice is defined as a dynamic global scale of the "flow" inside a space. A space has a high choice value when numerous of the shortest paths, that connect all spaces to all spaces of a system, passes through it (Klarqvist, 1993).
Depth between two spaces is the least number of syntactic steps in a graph that are required to reach one from the other.
According to "A Space Syntax Glossary"(Klarqvist, 1993) second order measures have been developed by correlating these four first order measures. *Intelligibility* (B. Hillier, 1989, 1996; B. Hillier et al., 1983) is the correlation between integration and connectivity and defines how far the depth of a space from the layout as a whole can be deduced from the number of its direct connections and *Synergy* (B. Hillier & J. Hanson, 1984) is the correlation between global integration and local integration.

For representing syntactic maps by space syntax in a graphical and numerical way , Turner (2001) developed the first version of Depthmap software. The software prepares visual graph analysis map that the result of the analysis is revealed by a range of colours from dark red to dark blue and also creates Excel numerical tables for integration, choice, connectivity and mean depth. It also draws diagrams for correlating measures such as intelligibility and synergy. Two scales of local and global are considered in all analyses. Global scale analysis shows a number of related elements from anywhere to anywhere in city, while in local scale, the analysis is limited to a certain area by a radius of 2 kilometre (R2) and 3 kilometre (R3).

4. Squares, Cities and Tourism

The Urban Dictionary defines a square as "a four-sided polygon characterised by right angles and sides of equal length," and more appropriately for our purposes, "a place where everyone gathers consisting of shops and whatnot." It is clear from this second definition that a square is a space for social interaction. Square has a positive influence on social interactions such as well managed festivals, community gatherings and meetings (Pugalis, 2009; Woolley, Rose, Carmona, & Freeman, 2004) and create a kind of civil-society (Woolley et al., 2004).

Fig. 1. Top-Vatican City. Peter's Square retrieved from Wikimedia 14/06/2015; Praca de Comercia in Lisbon retrieved from www.golisbon.com 14/06/2015

Pugalis (2009) argues based on some evidence that public space such as square has social, environmental economic sphere benefits. For example: Squares can attract employees ,customers and services for companies around the square (Woolley et al., 2004). Also, square can form the cultural identity and provide a sense of place (Pugalis, 2009). and can provide focal points, which is the heart of the city (Chesterton, 1997).
(Getz, 2008); Getz and Page (2015) and Getz (2008) have reviewed definition, evolution and prospect of event tourism. They believe that events are an significant motivation for tourists, and figure highly in the marketing and development plans of most cities. The events have an increasing position for destination tourism competitiveness. Based on their study spatial patterns is one of major sides of their reviewed framework for studying knowledge on event tourism.Considering high potential of squares for gathering people, holding concerts, national and international festivals, the squares may have high impact on the event tourism of the cities.
Fig. 1 shows the squares Peter's Square in Rome and Praca de Comercia in Lisbon. Both of squares with their huge areas are from the most tourist attractions in the city. Annually many concerts, festivals and video mapping are held in Praca de Comercia in Lisbon that attracts many tourists.

5. Tourism in Kuala Lumpur (Malaysia)

With the purpose of diversifying the economy and making it less reliant on exports, the Malaysia government has tried on plans and policies to rise tourism industry in Malaysia (Munan, 2002). In 2014, tourist arrivals in Malaysia were 27,437,315 people (Malaysia, 2015) that have a growth of 6.7% in comparison to 2013. Despite the economic crisis in 1998, tourist arrivals in Malaysia have been increasing consistently. Based on the same source,

between years 2007 to 2013, the number of arrivals has been increased from 20.97 million to 25.72 million. According to United Nations World Tourism Organization (UNWTO) Malaysia has been listed as the 10th most visited country in 2012 (UNWTO, 2012).

Tang and Tan (2013) also Tang and Tan (2015) have examined the relations of tourism in Malaysia with economic growth and also stability of it. .Tang and Tan (2015) argues that the role of tourism for economic growth of Malaysia is catalyst and policies to encourage inbound tourism can effectively stimulate economic growth.

Kuala Lumpur Structure Plan 2020 (KLSP, 2004) claims the capital city, Kuala Lumpur has a unique tropical character and has a developed service sector and infrastructures and with a wide range of tourist attractions. In this plan the vision for Kuala Lumpur that is consistent with the national vision is: Kuala Lumpur - A World-Class City. Second goal of five goals of this plan is "Goal 2: To create an efficient and equitable city structure." That is related to city configuration and city regeneration.

6. Kuala Lumpur City Center: Study Area

Kuala Lumpur city centre (KLCC) with commercial and administrative centre buildings like the Petronas Twin Towers attracts many visitors to it (Figure 3). The context of this study is an urban public park in the Kuala Lumpur city centre. The KLCC Area in Kuala Lumpur (Figure 4, Figure 5) was selected as a study area because this area is filled with historical and cultural heritage buildings. Also, the road Jalan Ampang passes through this area.

Fig. 2. Kuala Lumpur City Centre (Authors)

Based on Kuala Lumpur Structure Plan 2020, parks and open spaces create location for a variety of recreational and social activities, improve nature conservation and biodiversity. The KLCC Park is in the centre of KLCC forms 50 percent of the whole KLCC development area. The park was designed to provide greenery to the Petronas Twin Towers and the surrounding areas. The location of Kuala Lumpur city centre and the KLCC Park are illustrated in Fig. 4 (Ayeghi & Ujang, 2014).

Mohamed Ali and Nawawi (2006) argued that the KLCC Park seemingly was not meeting the needs of the visitors in terms of functional activities .The Kuala Lumpur Structure Plan 2020, also emphasizes that improving facilitators for recreational activities could also help popularize the parks among both residents and tourists (KLSP, 2004). In addition to a literature review, increasing numbers of visitors are exposed to the irregular geometry of urban space where the increasing number of skyscrapers is destroying landmarks (Etienne, 2003; Etienne, Berlie, Georgakopoulos, & Maurer, 1998). On the other hand, regular geometric design may differ from the urban design used in the development of a city (Lee, Sovrano, & Spelke, 2012).

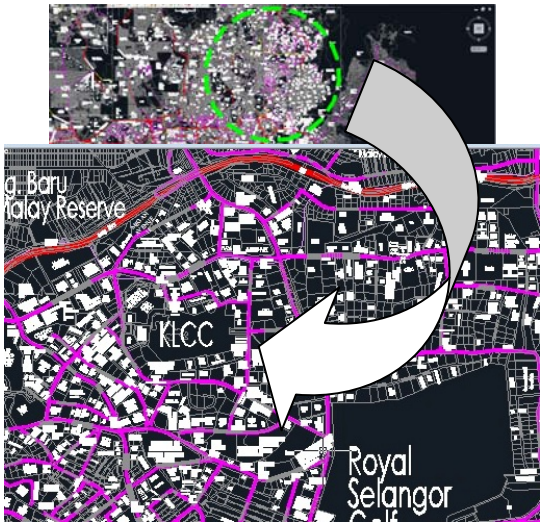

Fig. 3. Kuala Lumpour –KLCC (R=10km), (Digital map by UTM studio)

Fig. 4. KLCC (Google map)

Fig. 5. KLCC Park (Authors)

7. Methodology

Considering the role of space syntax theory in redesign and regeneration of the city, the theory analytical tools were applied in two steps. First the existed situation of KLCC PARK and surrounding streets network was analysed by Depthmap software. Global scale is considered to have a radius of 10 km from the KLCC

(Figure 3). The graph map and related data (integration, choice, connectivity, depth) were extracted from software. In graph map the darkest red coloured streets are the most integrated and the darkest blue coloured streets are the most segregated (the opposite of integrated). Second a square as a suggestion model was defined in the KLCC Park (Figure 4, Figure 5, and Figure 6).It should be mentioned that the proposed square should be implemented with keeping majority of greenery of Park. Also based on importance of waterfronts in urban tourism, all parts of water front's would be preserved.

After adding square to the map, the second analysis was conducted and again the graph and related data were extracted. Then the data of existed situation and proposed situation were compared from space syntax theory point of view. It is worth noting that existing streets are used to connect to the proposed square (Fig. 6). The analysis of the global network and the local network were considered. Both analysis methods (local and global) are very helpful in considering different scales of a spatial configuration; however, they could also be applied to indicate how an entire configuration was perceived by the observation of its parts. The comparison between local and global spatial configuration indicated the navigation of people through urban space. In other words, intelligible configuration is characterised (J. Hanson, 1989; J. Hanson, 1989; B. Hillier & Penn, 1996). Integration range considered in the study has a radius of 10 km from the KLCC; Integration HH is limited to the KLCC area; Integration HH (R2) is limited to the KLCC area (R=2Km) and finally Integration HH (R3) is limited to the KLCC area (R=3Km).

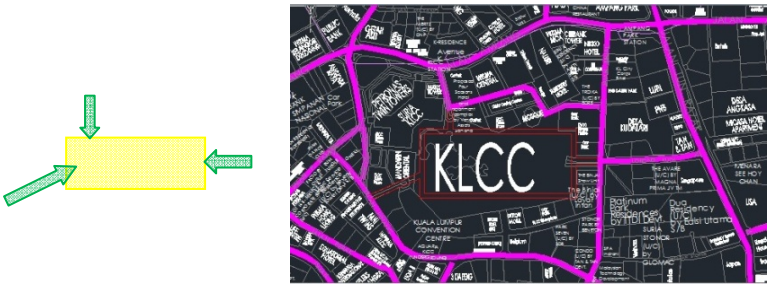

Fig. 6. KLCC map with square suggestion (base on UTM studio digital map)

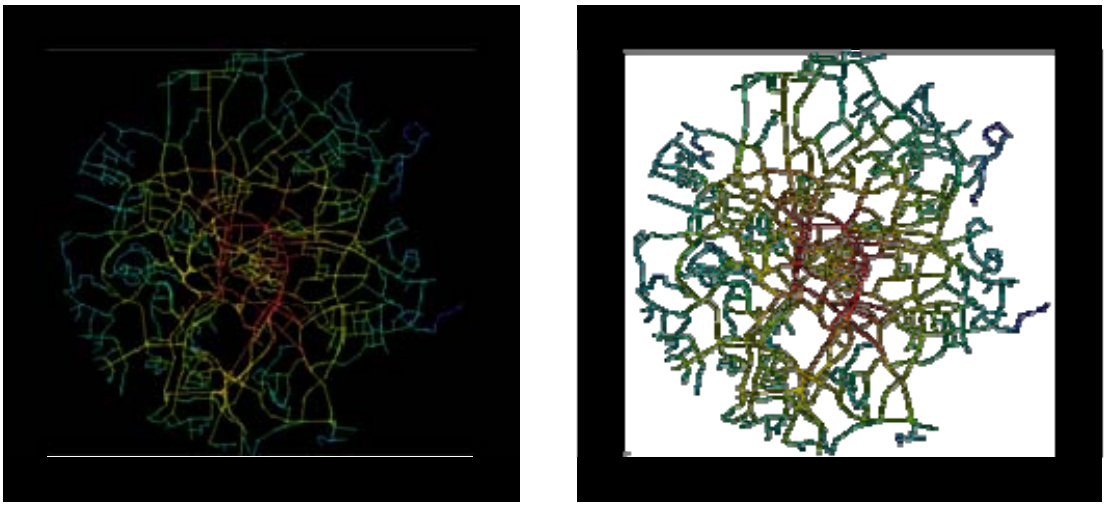

Fig. 7. Top-Integration (HH)-Kuala Lumpour-KLCC (R=10km)-existing Street, Down-Integration (HH)-Kuala Lumpour-KLCC(R=10km)-Suggested square model (Authors)

8. Results and Discussion

In modelling with Depthmap each axial line have a Ref number. Figue 9 shows the Ref numbers of all axial lines in all of streets networks. All the Ref numbers of Figue 9 can be compared with the Ref numbers in (Table1 and Table 2). Figure 8, Figure 10, Figure 11, Figure 12, Figure 13 illustrate the comparison between existing streets and the proposed square model in different configurations (global scale and local scale). The spatial configuration of the city as it exists now (Left of figures), is compared with what it would become if a network proposed by the square model is implemented (Right of figures).

As shown in Figure 11, a spectrum of colours is used for presenting integration of axial lines of streets that the dark red colours shows the highest integration and connectivity and the dark blue colours shows the least integration and connectivity. (Table1 and Table 2). presents the numerical characteristics (integration, choice, connectivity, depth) of both models and can be compared with Figure 9, Figure 10 and Figure 11(comparing graphical data with numerical data).

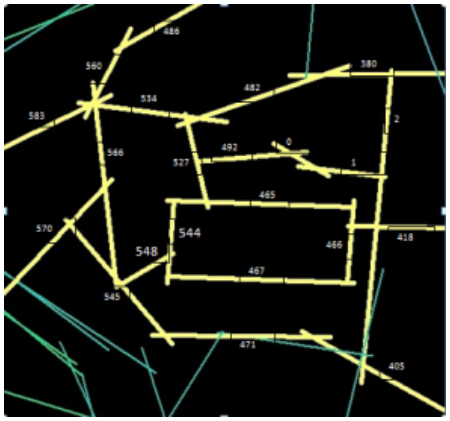

Fig. 8. Ref Numbers of streets (Authors)

model suggestion (Table1 and Table 2). However, in the local choice (R2, R3), there are no significant changes. It may be possible to accumulate flow growth, and this has an effect on additional activity in KLCC.

Based on the tables (Table1 and Table 2), connectivity in the two models (existing and suggested) are the same data except for a few changes to the data for streets 418, 527, 545, 566, and routes of a new suggested square. The reason can be because of the connection between the proposed square and these streets (Figure 10).

According to the tables (Table 1 and Table 2) and comparing global integration (Rn) in existing streets and the proposed model (Figure 11), the enhancement of global integration can be observed (as opposed to mean depth) for all streets in this area by using the suggested square model. Increased integration (decreased mean depth) may result in better accessibility in KLCC.

As for (Table 1 and Table 2) comparing local integration (R2) and mean depth (R2) in the existing streets and the proposed model shows three groups of data: The first group shows the same value; the second group shows increasing value; and ultimately, the third group shows declining value. In the first group, it can be seen that in the local (R2) evaluation, integration value is constant. All of the streets in this group are not directly connected to the proposed square. The second group includes the streets that link to the proposed square. Increasingly, it can be seen in this group's integration value increases. Lastly, the third group consists of one street (Ref. No. = 570). Unlike with all the other streets, the integration value is shown to decrease. This street is the second access route to the proposed square. Other reasons for network configuration probably affect it.

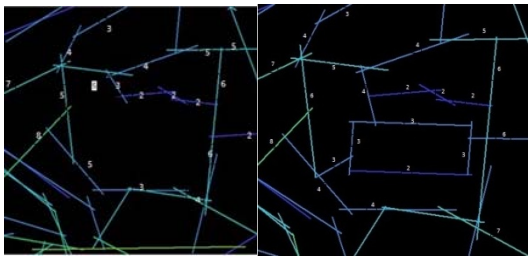

Fig. 9. Left-Connectivity-KLCC-existing Street, Right - Connectivity-KLCC- Suggested square (Authors)

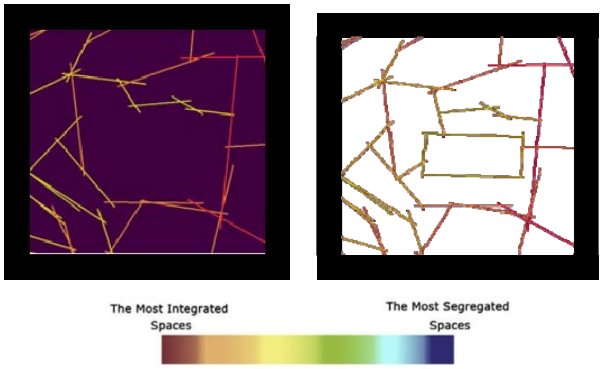

Fig. 11. Left-Integration(HH)-KLCC-existing Street, Right-Integration(HH)-KLCC-Suggested square (Authors)

Figure 8 compares the Global integrations with the radius of 10 kilometres for both models. In Figure 10, the connectivity of streets has been specified on the lines.

Figure 11, Figure 12, Figure 13 compare two models in terms of global integration (HH) and local integrations with radius of 2 and 3 kilometres.

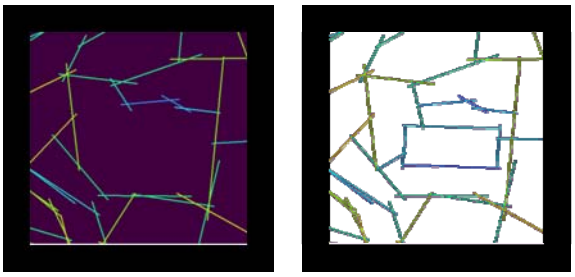

Fig. 12. Left-Integration (HH)R2-KLCC-existing Street, Right-Integration(HH)R2-KLCC-Suggested square (Authors)

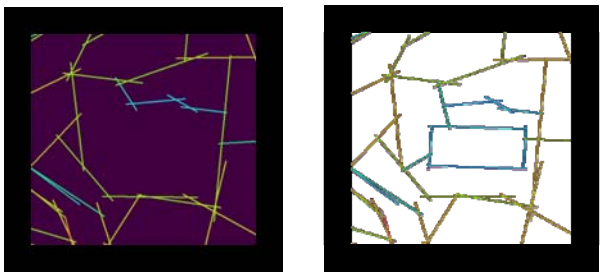

Fig. 13. Left-Integration (HH)R3-KLCC-existing Street, Right-Integration(HH)R3-KLCC-Suggested square (Authors)

As can be seen in the majority of streets near the KLCC, global choice of street can be increased by the square model suggestion (Table1 and Table 2). However, in the local choice (R2, R3), there are no significant changes. It may be possible to accumulate flow growth, and this has an effect on additional activity in KLCC.

Table 1
Characteristics of Street surround of KLCC-existing Street (Authors)

Ref NO	Choice	Choice (R2)	Choice (R3)	Connectivity	Integration (HH)	Integration (HH)(R2)	Integration (HH)(R3)	Mean depth	Mean depth (R2)	Mean depth (R3)
0	1025	2	6	2	0.64	1.06	0.989	13.33	1.5	2.45
1	3189	2	14	2	0.69	1.48	1.37	12.41	1.75	2.47
2	30983	24	94	6	0.76	2.93	2.07	11.41	1.65	2.47
380	93684	16	105	5	0.76	2.78	2.14	11.35	1.75	2.46
405	30881	28	147	7	0.76	3.24	2.35	11.38	1.70	2.48
418	40	1	2	2	0.72	1.74	1.61	12.06	1.82	2.52
465	-	-	-	-	-	-	-	-	-	-
466	-	-	-	-	-	-	-	-	-	-
467	-	-	-	-	-	-	-	-	-	-
471	11032	7	36	4	0.71	2.35	1.93	12.18	1.71	2.6
482	18384	8	43	4	0.73	2.31	1.85	11.91	1.69	2.55
485	7247	4	29	3	0.73	2.20	1.88	11.91	1.8	2.53
492	706	2	8	2	0.64	1.16	1.04	13.42	1.6	2.45
527	2569	4	18	3	0.67	1.83	1.51	12.74	1.67	2.45
534	14313	12	57	5	0.691	2.64	1.94	12.46	1.67	2.43
544	-	-	-	-	-	-	-	-	-	-
545	9472	4	32	3	0.69	2.20	1.86	12.45	1.8	2.49
548	-	-	-	-	-	-	-	-	-	-
560	6032	6	30	4	0.69	2.355	1.89	12.41	1.71	2.54
566	13043	12	68	5	0.69	2.75	2.10	12.35	1.74	2.4
570	9073	43	135	8	0.69	3.50	2.22	12.48	1.58	2.31
583	19647	24	103	7	0.69	3.21	2.23	12.41	1.65	2.27
Min	0	0	0	1	0.29	0.21	0.33	10.933	1.25	1.67
Max	337892	202	769	18	0.80	5.12	3.28	28.35	1.88	2.73

Table 2
Characteristics of Street surround of KLCC-with square suggestion model (Authors)

Ref NO	Choice	Choice (R2)	Choice (R3)	Connectivity	Integration (HH)	Integration (HH)(R2)	Integration (HH)(R3)	Mean depth	Mean depth (R2)	Mean depth (R3)
0	1090	2	6	2	0.64	1.06	1.01	13.30	1.5	2.5
1	3238	2	14	2	0.70	1.48	1.39	12.38	1.75	2.5
2	31596	23	99	6	0.76	2.94	2.11	11.38	1.67	2.48
380	96546	17	97	5	0.77	2.78	2.14	11.32	1.75	2.48
405	30607	28	145	7	0.76	3.24	2.31	11.36	1.70	2.5
418	6529	4	116	6	0.76	2.14	1.80	12.03	1.79	2.47
465	1069	4	20	3	0.64	1.83	1.47	13.35	1.67	2.34
466	3747	6	20	3	0.66	1.72	1.39	12.97	1.57	2.5
467	55	2	5	2	0.61	1.16	1.02	13.91	1.6	2.3
471	12752	8	43	4	0.71	2.40	1.97	12.15	1.74	2.60
482	21130	8	45	4	0.73	2.35	1.91	11.88	1.71	2.57
485	8044	4	31	3	0.73	2.20	1.89	11.88	1.8	2.54
492	732	2	10	2	0.64	1.27	1.18	13.39	1.67	2.43
527	5309	10	45	4	0.68	2.27	1.74	12.70	1.67	2.43
534	15564	12	64	5	0.69	2.69	2.02	12.42	1.71	2.44
544	383	4	14	3	0.62	1.72	1.32	13.78	1.57	2.34
545	12116	7	53	4	0.69	2.48	1.99	12.41	1.77	2.46
548	2264	4	21	3	0.66	1.90	1.61	12.95	1.7	2.52
560	7178	6	33	4	0.70	2.40	1.94	12.38	1.74	2.55
566	17153	19	100	6	0.70	3.0	2.21	12.32	1.71	2.39
570	10286	41	144	8	0.69	3.48	2.25	12.45	1.6	2.32
583	20318	24	109	7	0.70	3.21	2.26	12.38	1.67	2.3
Min	0	0	0	1	0.29	0.21	0.34	10.91	1.25	1.67
Max	338593	210	763	18	0.80	5.12	3.28	28.34	1.88	2.73

Finally, based on comparing local integration (R3) between existing streets and the proposed square model, the data show that local integration (R3) of all considered streets is increased. Of these streets two (418 and 527), have a further increase. These streets link one side of the proposed square to the other side of Jalan Ampang. Increasing the local integration (R3) may result in better activity in KLCC, particularly in streets that are connected to Jalan Ampang (see Ref. No. In (Firure 10).

The centre of Kuala Lumpur (KLCC), where there is a particular route system should show high integration, but against expectations, there is already low integration. The proposed square might result in better local and global integration in this area. As a result, activity and behaviour may be improved by the new spatial configuration.

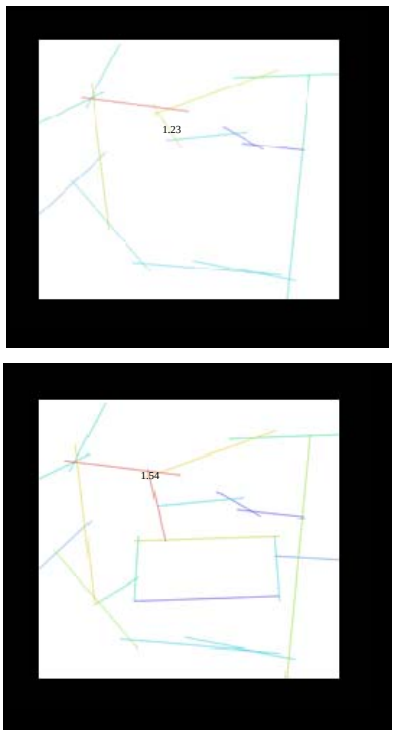

Fig. 14. Left (existing street) and Right (suggested model), integration (HH) of street of proposed in Fig 10 (Authors)

This model considered the streets as named in Figure 10.

The analysis (Figure 14) and the mean colour value (Figure11) show that the proposed square may have a positive effect on the integration of KLCC's streets. In particular, street 527(Figure 9) is connected from Jalan Ampang to KLCC. Integration in this street increased from 1.23 to 1.54 Figure 14. The change in the colour of this street to dark red can also be a reason for the claim Figure 14. Moreover, the proposed square can have impressive synergy. Scatter plots Figure 15 show that there is a further correlation between local integration and global integration with the proposed square. Based on the aforementioned figures, information about street 527 identified a rise in synergy (developing the interaction between the local and the global integration of the street) in this street (Figure 15). There is a good possibility that distribution of movement may be improved in this area. Correlation results between integration and connectivity shows that the element of configuration may well be higher intelligibility, particularly in the 527 street (Figure 16).

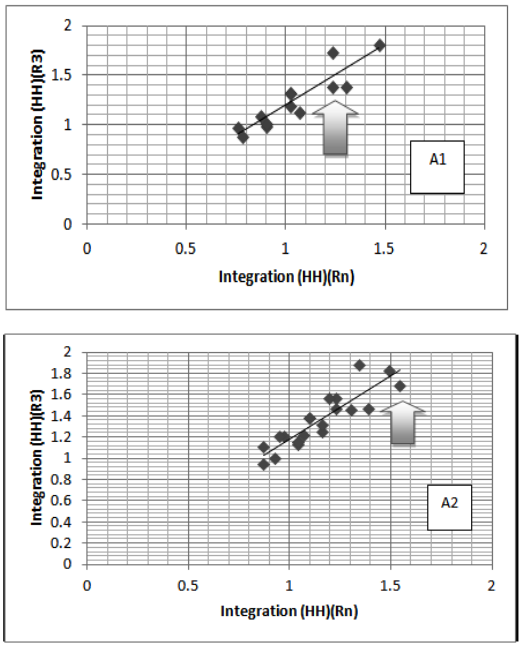

Fig.15. 2 Scatter plot of relationship between local and global Integration, A1-existing model, A2-suggested model (Authors)

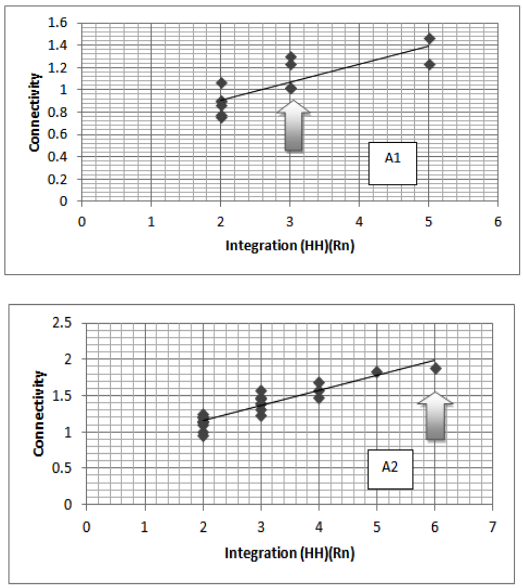

Fig. 16. Scatter plot of correlation between integration and connectivity, A1-existing model, A2-suggested model (Authors)

The findings of the study can be summarised as below:

1. A significance improvement of configuration of KLCC Park and surrounding streets in proposed square model in comparison with existed model has happened. According to (Penn, Hillier, Banister, & Xu, 1998) the configuration of the grid correlates constantly with the pattern of pedestrian movement and other problems such as distribution (Penn & Turner, 2004) and social behaviours (B. Hillier & Shu, 2000).In other hand based on significance of city configuration , accessibility and wayfinding in urban tourism the proposed square as a urban regeneration can a major help to tourist of KLCC centre.
2. Based on importance of squares for gathering people consequently a square can help to event tourism in KLCC.
3. According to (Chesterton, 1997) Context is necessary for significant or historic buildings (in our study Petronas Twin Towers). Squares can provide these contexts (Chesterton, 1997). Public spaces such as squares as well as streets are necessary for providing context of symbolic buildings, introducing culture as well as commercial activity (Mattson, 1999).

In this study suggested square can have a role of context for Petronas Twin Towers. It can also increase the legibility of city centre. Legibility allows for an urban space to be understood and memorized and is a major quality of a city (Lynch, 1960; Safari, 2016).

Our discussion suggests that square as a regular geometry might help create unity in urban design and effect intelligibility. Such designs would require highly legibility spaces, strong geometric forms, and high levels of integration and intelligibility. Areas of a city that lack legibility may be improved using geometric designs that would contribute to the legibility of the city. Even though it is impossible to change all configurations of a city, it is possible to renovate and refurbish some areas using regular geometry to contribute to legibility.

9. Conclusion

The aim of this study was examining space syntax as analytical and urban design aided to understand how city configuration may effect on accessibility and wayfinding of tourists in KLCC. This paper used the space syntax method to analyse the KLCC area. It is proposed to resolve some of the identified problems by using the suggested square model. The importance of subject is that with the changing city configuration as an urban regeneration we can facilitate the accessibility and wayfinding of urban tourists. Figure 1shows how the concepts of space syntax theory are connected with the concepts of urban tourism and also how proposing a square can effect on event tourism.

Spatial configuration analysis can be connected to several information layers in the urban space to make more suggestion models such as pedestrian movement, human behaviour, and other layers of information. By connecting spatial configuration to pedestrian behaviour, through a variety of methods such as regression analyses by different factors, a suggestion model can be proposed. The models seem to indicate the problem statement and have shown the ability to improve integration and intelligibility.

It seems that creating movement through the square model has benefited from the existing network. The new spatial layout seems to have improved the performance of the KLCC in terms of legibility, pedestrian flow and balance within the urban space. This conclusion is fed into the urban design process creating a suggested square model for KLCC. This is a good example of a case in which analysis can help generate design ideas or design conjecture. In other matters, analysis directly affects the formation of the initial design idea.

This analysis suggests that while the axes with the lowest Rn integration values are currently concentrated on the KLCC region, the proposed changes would move towards the axes in Jalan Ampang to KLCC region and especially through the KLCC. These results contribute to significantly improve the overall experience within the area, as illustrated by improvements in the global integration value (Rn) from 0.67 to 0.68. The local integration value (R3) would similarly increase from 1.51 to 1.74. There is a definite possibility that the level of intelligibility (correlation between integration and connectivity) of the urban space could also increase. Here it is emphasised that while this is not a significant numerical change, the level of intelligibility can change in the application of the suggested design. There is a strong possibility that the results are also important because the method is applicable to other problematic areas.

According to the simulation study, KLCC Park and surrounding streets (particularly 527 which are connected to Jalan Ampang) have been the lack of sufficient integration, choice and intelligibility. As a cultural heritage site, opening the city to visitors in addition to local users tends to contribute to the social, physical, and economic value of the region. Functions intended for tourism and investment in the region may provide improvements in wayfinding. In this way, intelligibility, accessibility, and synergy of this area can probably be expected to improve in the future with a minimum of disruption.

For future studies it is suggested to observe tourists in KLCC with the methods of people following, directional splits, static snap shot and gate observation and compare results with space syntax analysis.

References

1) Ayeghi, A., & Ujang, N. (2014). The impact of physical features on user attachment to Kuala Lumpur City Centre (KLCC) Park, Malaysia. *Geografia. Malaysian Journal of Society and Space, 10*(3), 44-59.

2) Bafna, S. (2003). SPACE SYNTAX A brief introduction to its logic and analytical techniques.
3) Buchanan, c. (1965). *Traffic In Towns: a Study of the Long Term Problems of Traffic in Urban Areas*. London: HMSO.
4) Chesterton. (1997). *Pedestrian Market Research Services Ltd. Managing Urban Spaces in Town Centres*. London: The Stationery Office.
5) Conroy-Dalton, R. (2003). The secret is to follow your nose. Route path selection and angularity. *Environment and Behavioral, 35*(1), 107–131.
6) Etienne, A. (2003). *How does path integration interact with olfaction, vision, and the representation of space?* (Jeffery J Ed.). Oxford, England: Oxford University Press.
7) Etienne, A., Berlie, J., Georgakopoulos, J., & Maurer, M. (1998). *Role of dead reckoning in navigation* (Healy S Ed.). Oxford: Oxford University Press.
8) Getz, D. (2008). Event tourism: Definition, evolution, and research. *Tourism Management, 29*(3), 403-428. doi:http://dx.doi.org/10.1016/j.tourman.2007.07.017
9) Getz, D., & Page, S. J. (2015). Progress and prospects for event tourism research. *Tourism Management*(0). doi:http://dx.doi.org/10.1016/j.tourman.2015.03.007
10) Gospodini, A. (2001). Urban design, urban space morphology, urban tourism: an emerging new paradigm concerning their relationship. *European Planning Studies, 9*(7), 925-934.
11) Gospodini, A. A. a. L., PH. (1998). *Sustainable Tourism Development of Chora of Myconos: Controlling the Abuse of Public Open Space and the Aesthetic Pollution of the Edi ces.* Paper presented at the International congress 'Sustainable Development on the Islands, Greece.
12) Haciomeroglu, M., Laycock, R. G., & Day, A. M. (2007). *Distributing Pedestrians in a Virtual Environment*. Paper presented at the International Conference on Cyberworlds, Norwich, UK, School of Computing Sciences, University of East Anglia.
13) Hanson, J. (1989). Order and structure in urban design: The plans for the rebuilding of London after the Great Fire of 1666. *Ekistics, 334/335(Jan/Feb, Mar/Apr)*, 22–42.
14) Hanson, J. (1989). *Order and Structure in Urban Space: A Morphological History of the City of London*. London: UCL.
15) Hill, M. R. (1984). *Walking, Crossing Streets, and Choosing Pedestrian Routes: A Survey of Recent Insights from the Social/ Behavioral Science*. USA: University of Nebraska Studies.
16) Hillier, B. (1989). The architecture of the urban object. *Ekistics, 56*(334/335), 5–21.
17) Hillier, B. (1996). *Space is the Machine: A Configurational Theory of Architecture*. Cambridge, MA: Cambridge University Press.
Environment and Behavior, 35(1), 17-29.
18) Hillier, B., & Hanson, J. (1984). *The social logic of space*: Cambridge university press.
19) Hillier, B., & Hanson, J. (1984). *The Social Logic of Space, Reprint*. Cambridge, UK: Cambridge University Press.
20) Hillier, B., & Hanson, J. (1998). Space syntax as a research programme. *Urban Morphology, 2*(2), 108–110.
21) Hillier, B., Hanson, J., Peponis, J., Hudson, J., & Burdett, R. (1983). Space syntax: A different urban perspective. *Architectural Journal, 30(November)*, 47–63.
22) Hillier, B., & Penn, A. (1996). Cities as movement economies. *Urban Design International, 1*(1), 49–60.
23) Hillier, B., Penn, A., Hanson, J., Grajewski, T., & Xu, J. (1992). Natural Movement: Configuration and Attraction in Urban Pedestrian Movement. *Environment and Planning B: Planning and Design, 19*.
24) Hillier, B., Penn, A., Hanson, J., Grajewski, T., & Xu, J. (1993). Natural movement-or, configuration and attraction in urban pedestrian movement. *Environ Plann B, 20*(1), 29-66.
25) Hillier, B., Penn, A., Hanson, J., Grajewski, T., & Xu, J. (1993). Natural movement: Or configuration and attraction in urban pedestrian movement. *Environment and Planning B: Planning and Design, 20*, 2029–2066.
26) Hillier, B., & Shu, S. (2000). *Crime and urban layout: The need for evidence; Key Issues in Crime Prevention and Community Safety* (V. MacLaren, S. Ballantyne, & K. Pease Eds.). London: Institute of Public Policy Research.
27) Karimi, K. (2012). A configurational approach to analytical urban design: 'Space syntax' methodology. *Urban Design International, 17*(4), 297–318.
28) Klarqvist, B. (1993). A space syntax glossary. *Nordisk Arkitekturforskning, 2*, 11-12.
29) KLSP. (2004). *Kuala Lumpur Structure Plan 2020*. Retrieved from http://www.dbkl.gov.my/pskl2020/english/vision_and_goals_of_kl/index.htm
30) LAW, S., CHIARADIA, A., & SCHWANDER, C. (2012). *TOWARDS A MULTI-MODAL SPACE SYNTAX ANALYSIS. Acase study of the London street and underground network*. Paper presented at the Eighth International Space Syntax Symposium, Santiago de Chile.
31) Lee, S., Sovrano, V., & Spelke, E. (2012). Navigation as a source of geometric knowledge: Young children's use of length, angle, distance, and direction in a reorientation task. *Cognition, 123*(1), 144-161. doi:http://dx.doi.org/10.1016/j.cognition.2011.12.015

32) Lynch, K. (1960). *The image of the city*. Cambridge: MIT Press.
33) Malaysia, T. (2015). Tourist arrivals and receipts to Malaysia. Retrieved from tourism.gov.my
34) Mattson, K. (1999). Reclaiming and remaking public space: Towards an architecture for American democracy. *National Civic Renewal*, *88*(2), 133–144.
35) Mohamed Ali, S., & Nawawi, A. H. (2006). Factors that influence users' satisfaction on urban park: comparison between KLCC park and Subang Recreation Park.
36) Munan, H. (2002). *Malaysia*: New York: Benchmark Books.
37) Penn, A., Hillier, B., Banister, D., & Xu, J. (1998). Configurational modelling of urban movement networks. *Environment and Planning B: Planning and Design*, *25*(1), 59–84.
38) Penn, A., & Turner, A. (2004). Movement-generated land-use agglomeration: simulation experiments on the drivers of fine-scale land-use patterning. *Urban Design International*, *9*(2), 81–96.
39) Pugalis, L. (2009). Achieving place quality. *URBAN DESIGN*, *109*, 14–15.
40) Safari. H. (2016a). Regular Geometry Towards Effective Visitors Wayfinding: A Case Study of KLCC Vicinity. Ph.D thesis. UTM
41) Safari,H.; FF Moridani,and SS Mahdzar (2016b). Influence of geometry on legibility: An explanatory design study of visitors at the Kuala Lumpur City Center. Frontiers of Architectural Research 5(4), 499–507.
42) Safari, H. and FakouriMoridani, F. (2017). Syntactical analysis of the accessibility and sociability of a square in the Kuala Lumpur City Center; Frontiers of Architectural Research(2017) 6, 456–468
43) Tang, C. F., & Tan, E. C. (2013). How stable is the tourism-led growth hypothesis in Malaysia? Evidence from disaggregated tourism markets. *Tourism Management, 37*, 52-57.
44) Tang, C. F., & Tan, E. C. (2015). Does tourism effectively stimulate Malaysia's economic growth? *Tourism Management, 46*, 158-163.
45) Turner, A. (2001). *Depthmap: A program to perform visibility graph analysis*.
46) UNWTO, W. T. O. (2012). The most visited countries in 2012. Retrieved from http://www2.unwto.org/
47) Woolley, H., Rose, S., Carmona, M., & Freeman, J. (2004). *The Value of Public Space, How High Quality Parks and Public Spaces Create Economic, Social and Environmental Value*. London: CABE Space.