

Can Street be Justice to Women Pedestrian?

Nurul Shakila Khalid, Yusfida Ayu Abdullah, Na'asah Nasrudin

Faculty of Architecture, Planning and Surveying,
Universiti Teknologi Mara (UiTM) Cawangan Selangor, Kampus Puncak Alam
42300 Bandar Puncak Alam, Selangor,
Malaysia.

shakilakhalid@uitm.edu.my, yusfida@uitm.edu.my, naasa717@uitm.edu.my

Abstract

The research aims to examine the spatial dominance by evaluating the relationship between the spatial configuration of streets network and the proportion of pedestrians. In analyzing the street networks in Space Syntax, the question arises; to what extent the movement and activity may explain street integration among gender-based pedestrians. The result found that there is a correlation between spatial configurative analyses and women present in the streets - the more integrated and localized streets attract more women pedestrians compared to the men. The research is relevant to spatial design interventions and policymaking to improve the gender-equal access to public space.

Keywords: spatial dominance; street; women pedestrian; space syntax

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1.0 Introduction

The aim of creating equitable streets in walkable is to invite people on the street or pedestrianization (Francis, 2016). Goodsell (2003) claims that in the transportation perspectives, the democratic street design is a subset of the walkable environment, those intended to support pedestrians and operated to enable safe access for all users. Democratic streets help achieve equity objectives by improving mobility and accessibility option for non-drivers. If the non-driving users are overrepresented by the poor, elderly, gender imbalance, and people with disabilities, then designing streets that give non-drivers a fair share of street space thus will make streets democratic (Zavestoki and Agymen, 2014; Beebeejaun, 2017).

Few studies examine the movement and activities that occur in urban public spaces related to the gender composition space (Arjmand, 2016; Beebeejaun, 2017; Francis, 2016; Khalili et al., 2015; and Souza et al., 2018). The current study addresses these limitations and fills a gap by counting women and men on streets that differ in space use. For the sake of diversity and spatial justice, it is essential that women feel safe, welcoming, and comfortable on urban streets as these areas provide great opportunities to engage in economic, physical, and social activity. Ever, street avoidance, safety or uneasiness, especially for women, become a concern especially female employment has increased in past decades thus show that women have had a strong presence in public spaces and make them be a part of urban life (Mehta, 2013; Tandogan and Ilhan, 2016; Beebeejaun, 2017). Indeed, women have reported that they are likely to experience public hassles and incivilities and be in the streets or public spaces. These studies have found the similar findings that assess street use by gender have identified women are often not quite half the users, as eloquently quoted by Souza et al., (2018). One of the factors contribute to the less absence among women in urban space is the perception of safety, poorly maintained buildings, homeless, strangers, crime hotspots, poor streetscape, gloomy business activities, and internal and street exterior (Tandogan and Ilhan, 2016; Arjmand, 2016). Previous feminist geography has examined the complex ways that gender articulated through spatial practices in urban spaces. One of the spatial methods, movement across space, reflects the interrelation between available resources and social identities to construct gender identities (Beebeejaun, 2017). Given this emphasis, the specific research question has been set up; (i) what type of activities among women pedestrians in urban public spaces, and (ii) to what extent spatial configuration measures the success of street as a public space for all. This study indeed contributes to the literature by offering insightful knowledge of the roles of public spaces with the effects on an everyday activity and social interaction by analyzing the spatial configuration of street networks.

2.0 Literature Review

Space Syntax is a method that consists of calculating configurative spatial relationships in built environments and measuring the accessibility of all parts of a network under consideration from each element. Developed by Bill Hillier and Julienne Hanson in the

1970s, Space Syntax explains the relationship between a spatial pattern and human behavior (Hillier and Hanson, 1989). Besides, configurational analyses and observational studies of cities have revealed that the spatial layout design includes the length, connectedness, and position occupied by each route of movement within the gridded system will influence the density of human movement and activities that occurs along with (Crucitti et al., 2006; Hillier, 2007). This theory provides the understanding that integration is a powerful predictor of how "busy" or how "quiet" a street activity is likely to be.

As the centre of this research, the significance of spatial structures in affecting the pedestrian activities and movement has been addressed through the framework of configurational analysis of Space Syntax (Hillier et al., 1993). Since pedestrian accessibility occurs according to the fine grain of the environment and to its city larger-scale structure, appropriately discriminating measures of street connectivity are critical for designing the street for equal accessibility. Indeed, several factors include spatial configuration, the attractions of co-presence, pathway infrastructures, and pedestrian comfort are essential to the accessibility measures for street's democracy.



Figure 1: The notion of gendered space in understanding their needs and behaviour has been concern in urban planning.

(Source: Arjmand, 2016)

In explaining the relationship between spatial configuration and gendered-space for women pedestrian, the literature provides an understanding of gender-based accessibility to public spaces. Space is a rendition of the social and political structures of society (Mehta, 2013). A spatial dichotomy based on a differentiation of female and male and their functions in the public space has served as the underpinning of the spatial arrangement of modern cities today. The city accurately embodies, among other things, the historical division of labor by gender within a normative society structure. Gender relations are implicated in our culturally constructed identity, where it is sanctioned that man should dominate space, and women's assigned place is in the house (Goodsell, 2003). This claim supports by Arjmand (2016) that the status differential between women and men creates specific urban spatial configurations related to the patriarchal spatial institutions that reinforce the dominance of men. He adds that the social system in place, through institutions of socialization, provides advantages to men that are denied to women. When spatial institutions are conceptualized and controlled by men, the space within which they operate can be said to be unfair in their favor and against women, making them effectively gendered spaces (Doan, 2010). Hence, women's lives in urban spaces are shaped by the visible and invisible boundaries created

by social structures. According to Beebeejaun (2017), discrimination toward women who do transgress the spatial binary and enter public spaces must contend with an internalized fear of male violence. Women who enter male-dominated public spaces may be subject to a wide range of verbal and physical harassment for transgressing the established boundary. Furthermore, other individuals whose identities reflect marginalized categories, such as race or sexual identities, also encounter this highly gendered spatial system and may feel exceptionally constrained in the ways that they may express themselves in public spaces controlled by the dominant regime of power (Beebeejaun (2017).

3.0 Methodology

Petaling Street and Kasturi Walk were performing the role of a pedestrian shopping street among locals and tourists. When one thinks of the colourful street and cultural street, Petaling Street come to mind before others. Established since the mid-19th century, Petaling Street or also known as Chee Cheong Kai means Starch Factory Street in Cantonese, referring to its history as the centre for the production of tapioca flour back then. With a wet market in the early morning, Petaling Street is one of the most famous imitations of "branded" items, selling various traditional foods, vegetables, trade, and presenting the public life in Kuala Lumpur. While Kasturi Walk is a covered and open-air flea market set along Jalan Kasturi, a street along with Kuala Lumpur Central Market, a historical craft centre.



Figure 2: Satellite image of Petaling Street (left) and Kasturi Walk (right), Kuala Lumpur (Source: Pleiades, 2020)

This paper developed two basic key ideas; spatial configuration and gender-based accessibility. Spatial configuration plays a role in pedestrian accessibility (Hillier et al., 1993). The spatial configuration affects pedestrians when they have to make the decision on what route they choose for their trips, or, encourage or discourage the route selection, which pedestrian can from arriving at the destinations. This scenario created a new niche in urban studies – the concept of the natural movement (Hillier et al., 1993). The natural movement various based on the distribution of configuration values in the axial map called integration (Hillier and Hanson, 1984).

Integration is an indicator of how easily one can reach a specific line of the axial map (Hillier et al., 1993; 2007). Integration measures the mean depth of every axial line. For the context of this research, the researcher employed two parameters in Space Syntax; local integration (micro-level) and global integration (the entire streets system). For the global integration of analysis, Space Syntax takes into consideration every possible relationship in the system – from anywhere to anywhere, whereas for the local integration analysis, only measure a particular local catchment area as three steps from the centreline. To achieve the research aim, an axial analysis of two shopping streets was done within a 3km radius using DepthMap. Figure 3 is the output of the axial line generated from the centreline of the street network in Kuala Lumpur.

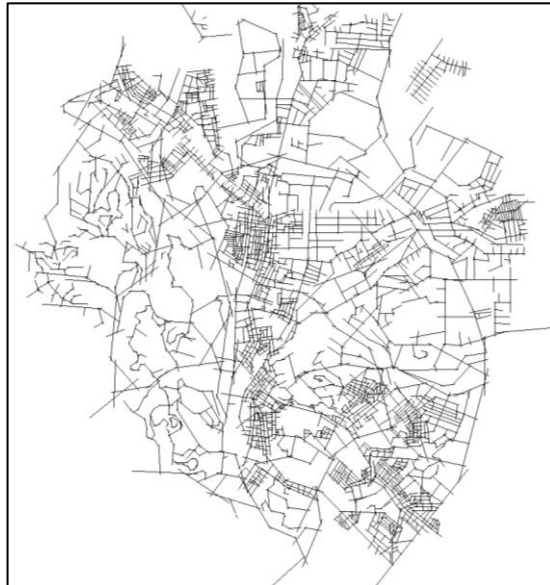


Figure 3: The Axial map consists of 2,437 street segments of radius 3km from the centreline of Petaling Street and Kasturi Walkwas audited in the DepthMap software.

To analyse the gender-based accessibility, the snapshot observations was applied to measure individual and social stationary activities among women pedestrian such as talking, eating, shopping, taking a photo, walking, smoking, and social activities engaged in and the number of the pedestrian in Petaling Street and Kasturi Walk, Kuala Lumpur. Pedestrians communicating with each other or engaged in everyday activities indicated as a group. The observation was scheduled for typically busy daylight times spread out on weekdays and weekends (weekdays 8.00 am to 8.30 am, 1.00 pm to 1.30 pm and 5.00 pm to 5.30 pm; weekends 11.00 am to 11.30 pm and 5.00 pm to 5.30 pm). The observations included (i) tracking number of people, (ii) duration of stay, and (iii) social activities engaged in the streets. Each observation was 15 minutes long to address the problem of observer fatigue. The literature studies of human activities and behaviour in public spaces showed that the duration of activities recorded in five-minute intervals. During the observation, the researcher acted as a participant-observer using the businesses and street space in the study areas. The researcher stands in the intersection in the centreline of the streets to record the social activities and count the number of pedestrians encountered using field notes. Besides, the research also applied photographs to record pedestrian behavior patterns and to verify the observation data collected.

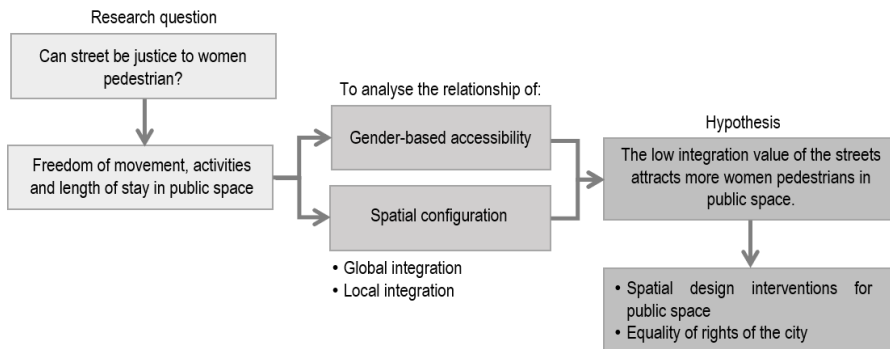


Figure 4: Theoretical methodology
(Source: Author)

4.0 Results

To develop the socio-spatial structure of the city analysis, the research observed the daily micro-actions for a better understanding of the women's experience, feeling, and social interactions in the public spaces. Therefore, the results were retrieved from the snapshot observations are compared using space syntax analysis.

4.1 Analysis of Street Network Configuration

Two analyses of the spatial layout pattern were conducted to address how to integrate and segregated the street networks for pedestrian trips (Hillier and Hanson, 1989). These

readings go from neighborhood scale to a city-scale as the main generator of patterns of movement. The first analysis was a global measurement (Rn), which helped observe the relationship between each axis and all other axes, and to show the degree of integration. The secondary analysis was a local measurement (R3), which helped to identify the relationship of an axis with its connected axes (up to three steps away). Local integration is the default indicator for human movement, as Hillier stated that people tend to take paths that minimize trip length or maximize trip effectively. This called natural movement, whereas natural movement identifies natural human activities in the configuration of the street network. It means that urban designers could predict social activities in the street.

The spatial layout pattern of Kuala Lumpur within the 3km radius shows that almost 80% of the area consists of a higher density of streets. This refers to the vehicular movement concentration in the central corridor of the transportation system. The concentration can be traced easily by looking at the street network, whereas the nucleus center happened along the major road in the city center (Hajrasouliha and Yin, 2015). For example, Jalan Tun Tan Cheng Lock, Jalan Tun HS Lee, Jalan Tun Perak and Jalan Hang Lekir dominated by vehicles and the loading and unloading activities that contributed to the traffic congestion. Notably, the layout patterns of Kuala Lumpur City Centre are semi-regular grid to very gridiron a non-uniform of distribution of land uses before the city begins to develop and extend. To measure the integrations, this paper refers to space/spatial as street and pedestrian paths of Kuala Lumpur. The pedestrian network includes all alleys, pathways, and pedestrian-only lane. Integration has analyzed to measure the accessibility of the spatial layout pattern from the very grid with mainly linear through streets to the fewer grids and a deformed grid at a city scale. The integration values in Space Syntax represent global and local integration value of Petaling Streets and Kasturi Walk, as represents in Table 1. Amongst the streets, only Petaling Street and Kasturi Walk are the pedestrianization for pedestrians to move, but with the multiple connectivities to each other streets.

Table 1: Syntactical values of Petaling Street and Kasturi Walk for pedestrian path networks compared to other streets

	Global Integration (Rn)	Local Integration (R3)
Petaling Street	0.823	2.891
Kasturi Walk	0.898	2.697
Jalan Benteng	0.875	1.666
Jalan Tun Tan Cheng Lock	0.823	2.833
Jalan Hang Lekir	0.825	2.938
Jalan Sultan	0.735	2.799
Leboh Pasar Besar	0.986	2.636
Jalan Tun Tan Siew Win	0.911	2.469
Jalan Tun Perak	0.963	3.098
Jalan Tun HS Lee	1.114	3
		.255

(Source: Author)

The global integration values range 0 (lowest) to approximately 1 (highest). The highest global integration value indicates the axial lines can be accessed from all other axial lines. Petaling Street and Kasturi Walk scored 0.823 and 0.898 for the global integration value. Both streets are approximately long 293m (Petaling Street) and 75m (Kasturi Walk) and can only be accessed by pedestrians. Kasturi Walk can be accessed by foot from Leboh Pasar Baru, LebohPudu, and Jalan Tun Sambathan to the Pasar Seni LRT and MRT stations. It can observe that the spatial layout pattern in both areas is likely grid, and buildings are located in a small cluster to encourage natural movement by foot.

The highest values of global integration are Jalan Tun HS Lee (1.114), Jalan Tun Perak (0.963), followed by Leboh Pasar Besar (0.986), and Jalan Tun Tan Siew Sin (0.911). These streets cater to more movements of vehicles and add to the higher street density. Jalan Tun HS Lee is amongst the highest value of global integration parallelly connected to roundabout Jalan Syed Putra. The second highest global integration value, Jalan Tun Perak specifically, is a long-stretched street of 810 m with 23m of width that attached to Jalan Pudu and highly visual connected to other nearby streets such as Jalan Tunku Abdul Rahman. While Leboh Pasar Besar and Jalan Tun Tan Siew Sin also move the vehicles with the short length of the street. These streets are accessible to pedestrians, but due to the multiple connectivities to the transit stops, higher traffic volume, and thus make pedestrians avoid using the streets.

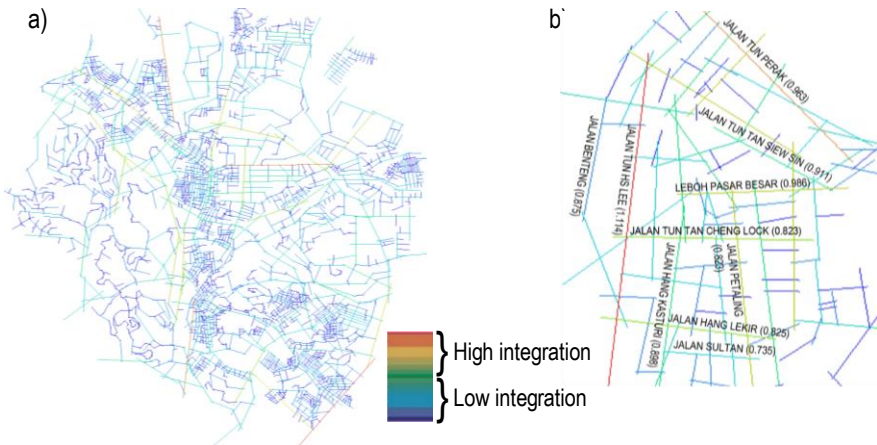


Figure5: (a) The higher value of the global integration concentrated in the central area of Kuala Lumpur (b) Enlarged view of selected streets connected to Petaling Street and Kasturi Walk. The result shows the more spatially integrated the street (represented by warmer colours; red to orange), the more pedestrian and car on the streets. In contrast, the more spatially segregated (cooler colours; green to blue) the streets are, the fewer pedestrian and vehicles on the streets.

The results of the local integration value represent in radius three. Figure 6 depicts the local integration measure that reflects the local scenario of a transportation network system.

The measures found that the most integrated locally is Jalan Tun HS Lee (3.255) and Jalan Tun Perak (3.098). Integration value for Petaling Street is 2.891, while the lowest integration value is Jalan Benteng (1.666). According to the space syntax principle, streets that had low integration values were safer and accessible by the pedestrian as it has proved that Jalan Benteng is fully accessible by pedestrian-only and known as riverfront along Sungai Klang and Sungai Gombak. Based on the observation in Petaling Street and Kasturi Walk, both streets are pedestrianized and locally high integrated. Pedestrians will easily be accessed both streets via other alternatives street as the layout pattern in mainly grid – short block and many options of routes.

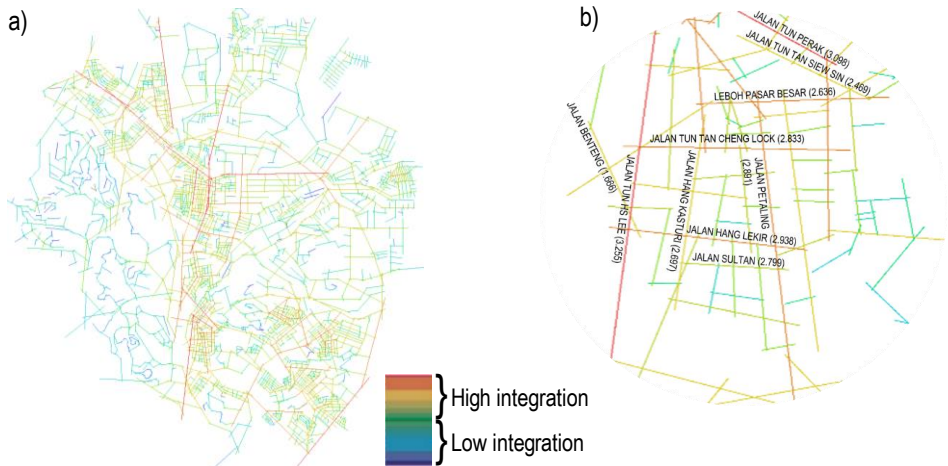


Figure 6: (a) The local integration map indicates the average depth of a space to all other spaces within three depths in the network system (b)The local integration results show that the highest locally integrated street is Jalan Tun HS Lee followed by Jalan Tun Perak and Jalan Petaling which is accessible by vehicles.

4.2 Analysis of Gender Proportion of Pedestrians

Table 2 present the proportions of total pedestrian, women, and men and how confidence intervals compare between women and men to identify the space uses. If democratic streets attract more people and women, people count will yield a supportive street main effect. The results also count for males, although this research did not hypothesise whether men favor the use of more pedestrian streets. The study applied the standard error because interested in the variability of sample means, and the mean is always in the center of the confidence interval. 95% of confidence intervals contain the actual means. If the interval is small, the sample mean must be very close to the true mean. Conversely, if the confidence interval is extensive, then the sample mean could be very different from the true mean, indicating that it is an inadequate representation of the population.

The result shows that women pedestrians made up proportion 0.35 of weekday users (SE 0.01, 95% CI [0.39, 0.45]) and 0.38 of weekend users (SE 0.02, 95% CI [0.55, 0.63]) in Kasturi Walk. Compare to the men pedestrian which score highest mean 0.46 of weekday users (SE 0.02, 95% CI [0.25, 0.29]) and 0.57 of weekend users (SE 0.02, 95% CI [0.45, 0.53]). To be observed, the proportion of women pedestrians slightly similar between weekdays and weekends, but the proportion of men was largely the difference between weekdays and weekends in Kasturi Walk. It can be said that men avoid being in public space during the weekend compare to women who play a role as a head of household, other than full-time workers.

The differences in proportions of women and men in Petaling Street as weekday and weekend users differed significantly. On weekday, the mean score for women pedestrian is 0.40 (SE 0.01, 95% CI [0.70, 0.83]) compare to 0.44 (SE 0.02, 95% CI [0.77, 0.85]) on weekdays. While men pedestrian recorded the mean score 0.51 (SE 0.02, 95% CI [0.66, 0.72]) and increased to 0.66 (SE 0.02, 95% CI [0.71, 0.82]) on weekend. Overall, the differences in proportions of women and males were largely significant in Petaling Street. It was clear that men use public space very differently than women. This finding also indicates that moving around in urban public spaces is a collective experience for women and men where different gender carry different roles in socio-economic and household responsibility. Above all, Petaling Street and Kasturi Walk score for integration values are slightly different - both streets are integrated and highly accessible for pedestrians, which resulted that the integrated street attracts more pedestrian but with different gender-based activities.

Table 2: Estimates of the proportion of total pedestrian, women and men by the streets

	Weekday			Weekend		
	Mean	SE	95% CI	Mean	SE	95% CI
Total pedestrian						
• Kasturi Walk	0.18	0.02	0.24, 0.38	0.31	0.02	0.69, 0.57
• Petaling Street	0.27	0.02	0.77, 0.62	0.36	0.01	0.57, 0.62
Total women pedestrian						
• Kasturi Walk	0.35	0.01	0.39, 0.45	0.38	0.02	0.55, 0.63
• Petaling Street	0.40	0.01	0.70, 0.83	0.44	0.02	0.77, 0.85
Total men pedestrian						
• Kasturi Walk	0.46	0.02	0.25, 0.29	0.57	0.02	0.45, 0.53
• Petaling Street	0.51	0.02	0.66, 0.72	0.66	0.02	0.71, 0.82

(Source: Author)

4.3 Analysis of Duration of Stay and the Pedestrian Activities

The score given is according to the Vitality Index by calculating the number of people engaged in individual and social activities and duration of stay. A place would appear vitality in two scenarios; (i) a large number of people for short durations, or (ii) fewer people staying for longer durations. Each pedestrian observed in stationary social activity accounted for a one-unit score. The duration of stay was recorded under five categories, as shown in Table 3.

The snapshot observation result suggests that pedestrians in Petaling Street spend 7 to 10 minutes both for women and men pedestrians. The highest number of pedestrians has a significant relationship with the duration of stay, offers a variety of goods and businesses that meet the needs of locals and tourists. It observed that women pedestrians engaged in social activities such as bargaining, shopping, and eating by spending 7 to more than 10 minutes. Besides, the street length is 293m compared to Kasturi Walk, which is a 75m long stretch, which gives ample time for a pedestrian to stroll, and the walking environment is more convenient.

Observations in Kasturi Walk discovered on weekdays and weekends highlighted the difference in their duration of stay. On weekdays, pedestrian stayed there for a short length of less than 1 minute compare to in Petaling Street. Conversely, during the weekend, the length of stay increased from less than 1 minute to 5 minutes as the most significant number of pedestrians among locals and tourists enjoy the sightseeing, lingering, eating, shopping and appreciate the decorations in Kasturi Walk by taking the photo. Most of them spent more time (in less than 5 minutes) in food stalls compared to the souvenirs shops that sell the key chains, clothing, toys, handcraft, and accessories. They prefer to be in the Central Market due to the scorching hot weather the outside. The narrow space gives the inconvenience for women pedestrians who are strolling around with the infant in the stroller. Besides, there is no seating area or benches provided along Kasturi Walk except the seating for the food stalls.

Table 3: Duration of stay of pedestrians in Petaling Street and Kasturi Walk

Duration of Stay	Score					
	Petaling Street			Kasturi Walk		
	Women	Men	Mean	Women	Men	Mean
15 sec to <1 min	5.0	5.0	5.0	1.0	1.0	1.0
1 min to <3 min	7.5	7.5	7.5	3.0	1.0	2.0
3 min to <5 min	10.0	7.5	8.75	7.5	5.0	6.25
5 min to <7 min	15.0	10.0	12.5	12.5	10.0	11.25
7 min to > 10 min	12.5	12.5	12.5	12.5	12.5	12.5

(Source: Author)

5.0 Discussion

In this research, the integrated street draws more people and enhance walkability. However, in contrast to the results of the integration value of Kasturi Walk, the less integrated street encourages fewer people present in a shorter duration of stay. More integrated streets, Petaling Street, are more accessible likely to attract more women pedestrians. In this sense, Space Syntax is useful to provide a better understanding of the role of the street network in supporting public life because it deals with both spatial and functional aspects of street space. However, many other factors contribute to the lack of absence of pedestrians in the streets. The factors contributed may the land use pattern, pathway and street

infrastructures, public transportation system, urban design, and built environment qualities, and types of activities include economic and social activity.

The results of the proportion between women and men in uses of public spaces show that many factors influence the presence of women; a variety of goods and services, a group of users, accessibility and walkability, and convenient. However, women pedestrian-only being in the streets in a short time and rush. The observation results found that only women tourists stroll. The different group of women pedestrians carries different objectives of being in the streets. To compare the range of activities and goods in both streets, Petaling Street is the preferable place to be visited by women. When the street offers a variety of products, it will consequently encourage social engagement and social exchange. The pattern of activities taking place in the streets justifies that people intuitively re-configures the space for their best uses.



Figure 7: Women are always seen in public space during daytime when they have a purpose – going to work, market to buy groceries and other such activities.



Figure 8: There is an intense and democratic use of the space in Petaling Street by women and men of different age, race and nationality, and a diversity of activities taking place there.

This research has no attempt to evaluate to what extent women pedestrians feel safe in the aspect of crime and built environment or urban design. This research only reveals the everyday activities and movement and how women pedestrians were feeling of safety when in crowded places, surrounded by men and foreign workers. The feeling of safety in the crowded and congested streets may influence by the presence of many people, patrolling by the police, segregated lane between pedestrian paths and road, and the small-scale commercial activity along the streets. Women's experience of safety in urban areas is different compared to men, especially when the area dominance by men. Besides, the level of fear among women pedestrians is varied by location, time of day, mode of transport, and the setting of other uses.

Returning to the question of how justice the street is, spatial justice among women pedestrian, the research findings are manifold – women pedestrians dominant the streets. However, statistically, the number of men pedestrians is higher than women pedestrians. Indeed, the pedestrian volume challenging to compare with the activities happening in the less integrated streets like Kasturi Walk. The research thus suggests the further research to understand the street network patterns; the structured observation that carried in this research could not answer the vital question about how democratic and equitable the streets are, of who might benefit most, who “own” space, or who will avoid the street and why.

6.0 Conclusion

The research attempts to refocus the attention to people and places rather than land users to become truly democratic and equitable public spaces for everyone. The gendered division of the urban spaces is undoubtedly. They also reflect the realities about the relationships between women and men within the family and in society. The space outside the home becomes the space in which social relations are produced, while the internal space of home becomes that in which social relations are reproduced. Hence, urban planning and architecture set the conditions in defining the habitus of gender and demarcating the interaction of women and men in space. Yet, in conclusion, a successful public space is one where users of different backgrounds can coexist without one group dominating another.

The findings show that the application of Space Syntax in examining the spatial configuration of the street networks in a city makes it as a baseline study to employ the idea of how a constructed space can contribute to a place's ideal for social and functional dimensions. Moreover, the findings add to providing better insights on spatial design interventions and spatial design normative policymaking to help urban designers, architects, urban managers, and the local governments. They are the typical aspects for them to understand how urban space works the way they do as well as to deliver the social, economic, and environmental expectations of the pedestrian particularly.

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