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Investigating the Socio-Economic Dimensions of Shopping Open Spaces before and after COVID-19 Case Study: Green Plaza Mall, Alexandria, Egypt

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Abstract

The study focuses on the spatial configuration of shopping mall design and its effect on social behavior and economics of the project. The design of Urban Open Spaces (UOS) in shopping mall can affect the success or failure of the project. In this paper as part of research project in studying the shopping Urban Open Spaces (UOS) in commercial projects in Alexandria, the study focuses on using observational techniques such as gate counts, static snapshots, and photographing to understand the effect of shopping mall design on frequency use of the space and its effect on the economics of the project. Moreover, space syntax computational techniques such as Visibility Graph Analysis (VGA), agent simulation and isovist points analysis are used to understand the spatial configuration of the studied shopping mall. There were two sides of the problem, the social side of the problem and the financial side of the problem, finding out that when a shopping mall fails to facilitate social gatherings through its central spaces, there would be a drop in financial terms of the project such as higher vacancy rates in commercial spaces and drop in renting rates. The research is focusing on studying this situation in Green plaza shopping mall in Alexandria as a case study before and after COVID pandemic in order to find out the similarities and differences in this pattern and to discuss recommended design criteria for shopping malls in Post-COVID. The results obtained can be used to more understanding of what design decisions affect the success or failure of shopping malls.

Keywords

Urban Open Spaces, Gate Count, Social Behavioral Mapping, Static

Snapshots, COVID-19

1. Introduction

In contemporary consumer communities, shopping malls extended its main role of obtaining goods to fill social and emotional needs; shopping mall at urban design scale is planned to nurture these needs. As many previous urban studies are dedicated to interpreting the complexity of the relations between human behavior, experience and urban spaces (Jacobs, 1961; Lynch, 1960). These studies are extended by numerous spatial-temporal factors that would make a city as a holistic integrated social entity (Gehl, 1987, 2010, 2011; Whyte, 1980; Amin & Graham, 1997). Unifying space and time in new social theories can reinterpret the complexity, temporality and occasionality of social studies in urban spaces (Adam, 1998; Dodgshon, 2008; Harvey, 1996, 2009; Massey, 2005). In Urban Open Spaces (UOS) of shopping malls, unifying space and time is essential to trace, interpret and response of social studies on urban spaces and finds its relation to the success or failure of these commercial projects, in which, success of such types of projects depends mainly on financial and investing measures. This linear cause-effect relation between social success of UOS and its implications on financial and investing terms can affect the prosperity of the hosting city as holistic integrated social entity.

Today, the existing event of spread of COVID-19 has two effects on such type of projects. Firstly, the health dimension in which can contradict with the social dimensions. Secondly, the financial dimension in which as discussed previously act as an effect of the success of the social dimension. The dilemma is that we cannot know how the current contradiction between health and social dimension as a temporarily or permanent problem can affect the socio-spatial environment in our cities. Many researchers (Salama, 2020; Badger, 2020; Lichfield, 2020) ask questions related to the mentioned dilemma between health and social dimensions.

After the shift of predicted paradigm, followed by the extent of the COVID-19 pandemic, e-commerce and online shopping increases. However, existing shopping centers would be affected by COVID-19 pandemic. Shopping centers should continuously play its social and economic roles as it serves as important roles in shaping cities today. Socially, shopping centers are considered the dynamic living places in which a diversity of social behavior can be held there as people can meet and interact. Economically, businessmen or investors in these projects can affect the economic conditions in the city by delivering employments and acting to serve as linking units in the commodity chain between producers and consumers (Novak & Gilliland, 2011).

2. Green Plaza Shopping Mall Context

In contemporary cities, shopping places are the vital social hubs of the city.

Shopping mall centers are spread in large cities in 1960s and 1970s which is a shift from urban shopping streets to these central shopping centers. In 1980s and 1990s there was a huge shift in the size and the power of the shopping malls in reshaping social and economic conditions in the city (Simmons, 2012).

In the second largest city in Egypt, Alexandria city's shopping places can be categorized as old urban shopping street, indoor shopping malls and outdoor shopping malls. As shown in **Figure 1**, old urban shopping streets located mainly near eastern and western harbor such as in Mansheya district. While located at the east of the eastern harbor such as Zahran mall, Kirosiez mall, Wataniya mall, San Stefano mall Mina mall and Deeb mall. While green plaza mall as outdoor shopping mall is located at southern Smouha district in Alexandria. The green plaza mall was selected for this study as it's the only mall based mainly on outdoor open spaces to provide social activities. As shown in **Figure 1**, green plaza mall is about 10 minutes away from the airport and about 10 kilometers from Bibliotheca Alexandrina and Alexandria National Museum.

Green plaza shopping mall is an outdoor mall of about 1,129,800 square feet in which considered the largest mall in Alexandria (Snider, 2012). It's one of the largest ten malls in Egypt and one of the largest fifty malls in the Middle East (Snider, 2012). This international-style shopping mall is built in 2002 and was designed around elongated open spaces. The mall is consisting of three floors. The ground and first floors are consisted mainly of shops in which shopping area is considered more than half of the green plaza mall area. The first-floor shop zones are connected by two bridges (B1 and B2) over western UOS 3 as shown in **Figure 2**. While the second floor was locating Hilton Hotel rooms to overlook the open spaces of the mall. The main elongated spaces are used as access paths in ground floor (P1, P2 & P3) and have three entry open spaces (UOS1, UOS 2 & UOS 6). The shopping mall consist of one important anchor space at the south end at UOS 5 in which surrounded by cinema, restaurants and considered access space to south eastern hyper-market and children's arcade. Other vital elongated space is the eastern UOS 7 in which is parallel to main external street. At ground floor there is a central UOS in which surrounded by escalators and stairs to get to the first floor through surrounded mezzanine corridor of UOS 8. While at UOS 5 there is the second access point to first floor at UOS 9 in which serve as open space for southern food court.

3. Methodology

The methods used in the research are categorized as observational and computational studies. Observation study is used through site visit for several times for observing visitors' preferences in green plaza mall. According to initial observation, most visitors go to the plaza mainly for the cinema, restaurants, hypermarket and child zone. Number of studies was done within two visits before and after COVID-19 which are static snapshots and gate counts. On the other hand, for more deep understanding of spatial configuration of open spaces, space

Figure 1. Green plaza mall in Alexandria city (Edited from Snider, 2012).

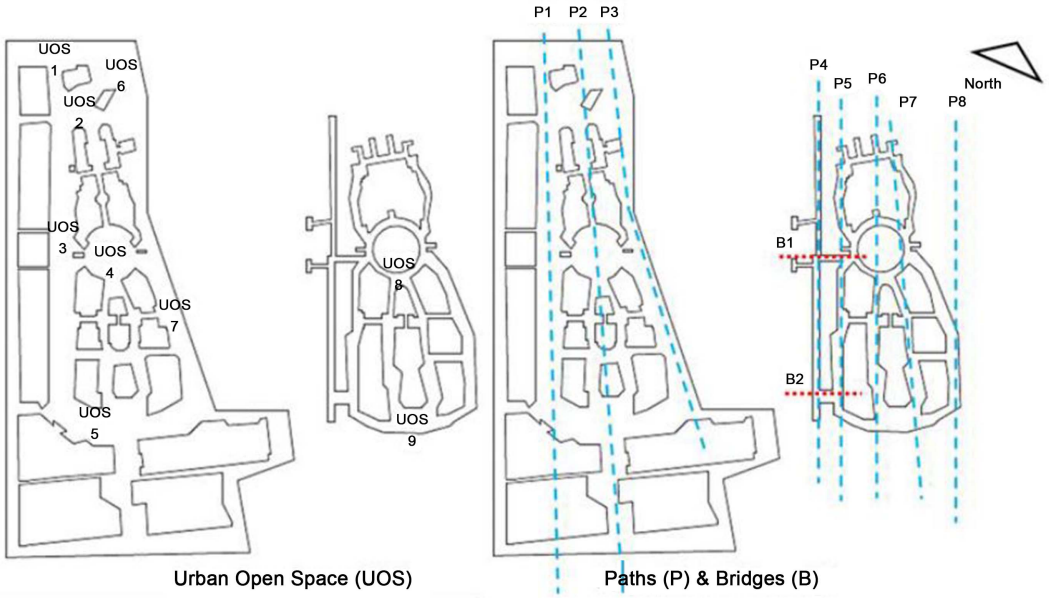


Figure 2. Indicated main Urban Open Spaces (UOS), Paths (P) and Bridges (B) in the ground and first floor in Green plaza mall.

syntax was used. From Visibility Graph Analysis (VGA) to agent simulation of gate counts is used as space syntax calculations to give more understanding of the shopping mall situation.

3.1. Observational Study

Through Ethnographic design approach the researchers will discover the direct and indirect correlation of spatial configuration of a building design on the Social behavior of visitors in green plaza mall. Also, the study will clarify the pros and cons effect of the COVID-19 epidemic on the Social and Financial activities in the mall, considering this crisis as a master factor and challenge to designers, investors and finally visitors. This study will initially focus on observational studies in order to: a) define the average number of visitors before & after COVID-19; b) Illustrate Customer Circulation Behavior relative to building blocks and classify their motion into main, secondary and static paths in addition to the main entrance and exit nodes as shown in **Figure 3**; c) identifying the spatial

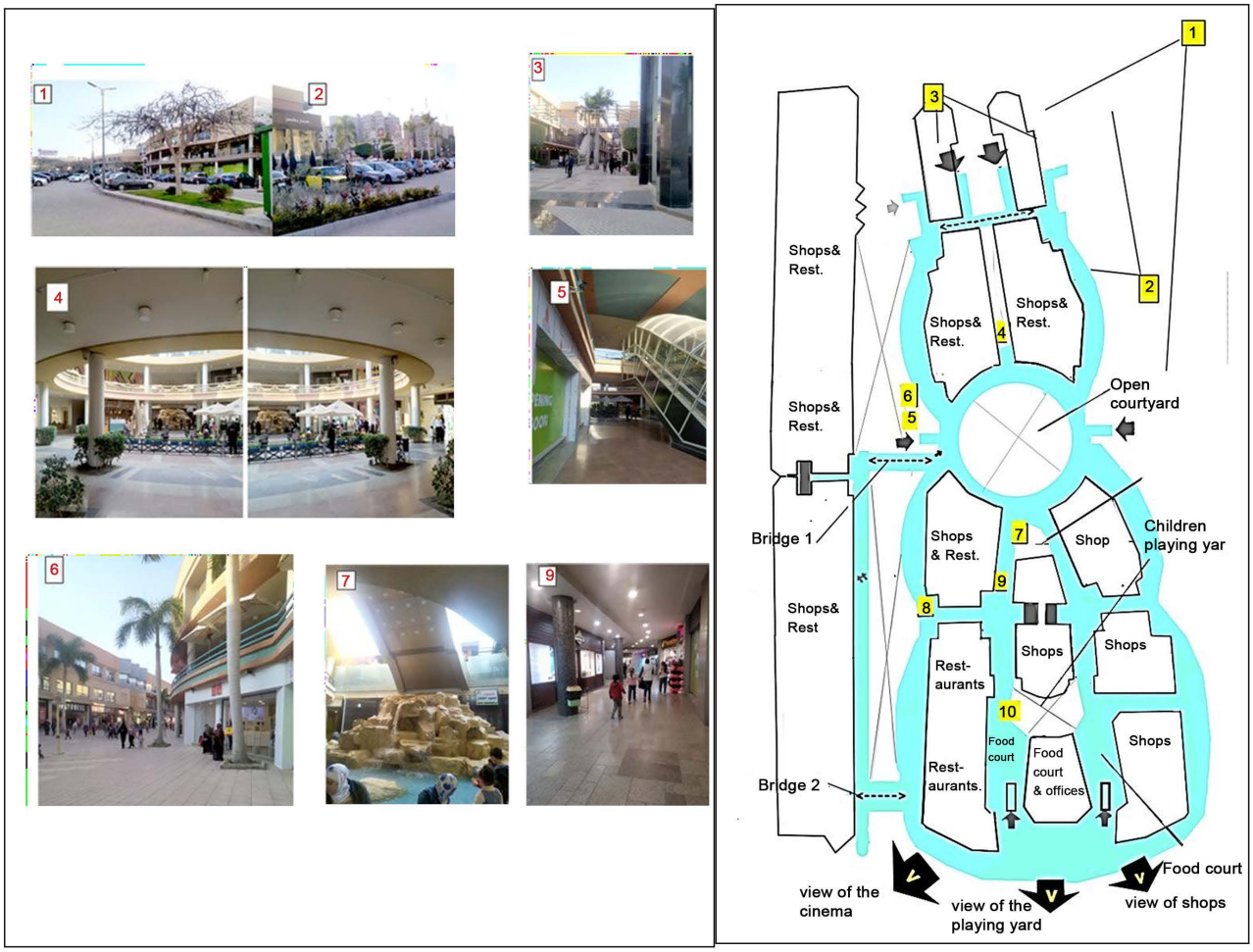


Figure 3. Showing the static snap shots of vital transitional points in green plaza mall.

proportions through taking captions inside, outside and surrounding the mall; d) finally calculating the gate counts of visitors before and after COVID-19.

The Observational Study is Clarified and Simplified in to a comparison diagrams built by the researchers to distinct between building blocks, courts, sitting areas and kids stations. Those diagrams are referenced from Google maps before and after the spread of the epidemic.

3.1.1. Spatial Static Snap Shots

Firstly, as shown in **Figure 3**, static snap shots study was done to observe the existing conditions of the vital transitional points in green plaza mall.

3.1.2. Gate Counts before and after COVID-19

Gate counts are used directly to observe the density of pedestrian movement flows in green plaza mall. In this study, gate counts are observed as cross-sectional study that was done in the weekend days of Thursday and Friday as most people in the city can go out for outdoor social activities. These days was taken at 4th and 5th of January in 2018 for before COVID-19 study and at 6th and 8th of January in 2022 for after COVID-19.

Ten gate counts are coded to cover a range of well-used, moderately-used and poorly-used spaces in and around the boundaries of the main areas in green plaza mall. As shown in Table 1, the gate counts are studied within 2.5 minutes through three time intervals (T1, T2 and T3) at 15:00, 17:00 and 19:00 pm as started from gate G1, it was taken from 5 to 10 minutes to get from studying one gate to the following gate because the large distances in the site. Table 1 shows the counted males and females in each gate through time intervals before and after COVID-19.

The gate counts observed data are summarized in Figure 4. As shown in Table 1 and Figure 4, gate G1 and G7 was the most important gates as they have the highest frequency of use. Before COVID-19, G1 had total of 91 female and 88 male counts and G7 had total of 93 female and 91 male counts. After COVID-19, G1 had total of 81 female and 71 male counts and G7 had total of 69 female and 73 male counts. These gates G1 and G7 show high percentage of female presence due to they are open gates which are considered the safest places in the mall also they are vital anchor points of movement in the mall.

Generally after COVID-19 as shown in Figure 4, there is relatively similar fall range of gate counts at most of the gates and in gate G9 specifically there is significant high fall of gate counts as observed in which G9 is the gate to the open space in front of the hypermarket.

3.1.3. Rented and Vacant Shops before and after COVID-19

Economically, the above-mentioned situation of gate counts and number of users has great effect on observed commercial spaces in the mall. The study focused on central shopping mall and excluded the southern commercial spaces from the study. In the studied zone in green plaza mall, the commercial spaces can be divided into 132 shops (standalone shops or food court shops), 10 cafeterias, 11 restaurants, 2 offices, 2 kids store and 1 bank. As observed, most of shop renters are paying high annual rent in which add to the cost of their product. Thus, factors like the number of users, the presence time of users in the mall and the visibility of commercial spaces are vital for the economic success of the mall.

As shown in Table 2, before COVID-19, the total number of rented commercial spaces is 116 space while vacant commercial spaces are 43 space which means about 73% rented spaces in the selected zone. The total number of commercial spaces is 159 spaces divided into 90 space at ground floor and 69 space at first floor. At ground floor, about 84% of commercial spaces are rented. While at first floor, about 58% of commercial spaces are rented. This observed data shows that there is decline in the commercial activities at the first floor which mostly affected by the design of the shopping mall.

After COVID-19, the total number of rented commercial spaces is 49 space while vacant commercial spaces are 110 space which means about 31% rented spaces in the selected zone. At ground floor, about 30% of commercial spaces are rented. While at first floor, about 32% of commercial spaces are rented.

Table 1. Gate counts in green plaza mall before and after COVID-19.

Gate No.	Day	Before COVID-19 (Jan-2018)				After COVID-19 (Jan-2022)			
		Time Intervals (2.5 minutes)			Total	Time Intervals (2.5 minutes)			Total
		T1	T2	T3		T1	T2	T3	
G1	D1	12 M + 16 F	9 M +13 F	15 M + 13 F	**88 M + 91 F**	6 M + 5 F	10 M + 15 F	18 M + 20 F	**71 M + 81 F**
	D2	15 M + 17 F	14 M +15 F	23 M + 17 F		10 M + 11 F	11 M + 12 F	16 M + 18 F	
G2	D1	4 M + 2 F	2 M + 3 F	3 M + 2 F	**25 M + 12 F**	2 M + 1 F	3 M + 0 F	2 M + 4 F	**16 M + 8 F**
	D2	5 M + 1 F	3 M + 3 F	8 M +1 F		2 M + 0 F	4 M + 1 F	3 M + 2 F	
G3	D1	7 M + 12 F	5 M + 6 F	11 M + 9 F	**44 M + 52 F**	4 M + 5 F	3 M + 6 F	7 M + 4 F	**25 M + 34 F**
	D2	5 M + 13 F	4 M + 4 F	12 M + 8 F		5 M + 8 F	2 M + 7 F	4 M + 4 F	
G4	D1	5 M + 1 F	1 M + 2 F	3 M + 0 F	**21 M + 5 F**	2 M + 1 F	0 M + 3 F	1 M + 2 F	**9 M +7 F**
	D2	4 M + 0 F	2 M + 2 F	6 M + 0 F		1 M + 2 F	1 M + 1 F	4 M + 0 F	
G5	D1	0 M + 2 F	3 M +2 F	2 M + 0 F	**10 M + 7 F**	1 M + 2 F	5 M + 1 F	0 M + 2 F	**7 M + 9 F**
	D2	1 M + 3 F	3 M + 2 F	1 M + 0 F		0 M + 2 F	1 M + 2 F	0 M + 0 F	
G6	D1	3 M + 2 F	1 M + 1 F	4 M + 0 F	**13 M + 7 F**	2 M + 1 F	1 M + 3 F	3 M + 0 F	**10 M + 5 F**
	D2	2 M + 1 F	1 M + 2 F	2 M + 1 F		1 M + 0 F	2 M + 1 F	1 M + 0 F	
G7	D1	11 M + 17 F	15 M + 14 F	14 M + 18 F	**91 M + 93 F**	9 M + 8 F	16 M +13 F	18 M + 20 F	**73 M +69 F**
	D2	13 M + 14 F	15 M + 13 F	23 M + 17 F		5 M + 4 F	11 M +11 F	14 M + 13 F	
G8	D1	5 M + 2 F	4 M + 4 F	8 M + 2 F	**37 M + 14 F**	2 M+ 3 F	1 M + 5 F	6 M + 2 F	**22 M + 15 F**
	D2	7 M + 2 F	5 M + 3 F	8 M + 1 F		2 M + 2 F	2 M + 2 F	9 M + 1 F	
G9	D1	2 M + 2 F	7 M + 7 F	6 M + 4 F	**31 M + 27 F**	0 M + 2 F	1 M + 0 F	4 M + 5 F	**15 M + 12 F**
	D2	3 M + 2 F	5 M +8 F	8 M + 4 F		1 M + 1 F	3 M + 1 F	6 M + 3 F	
G10	D1	8 M + 5 F	6 M + 8 F	10 M + 6 F	**37 M + 39 F**	3 M + 4 F	5 M + 7 F	9 M + 10 F	**29 M + 32 F**
	D2	4 M +5 F	3 M + 5 F	6 M + 6 F		2 M + 2 F	4 M + 4 F	6 M + 5 F	

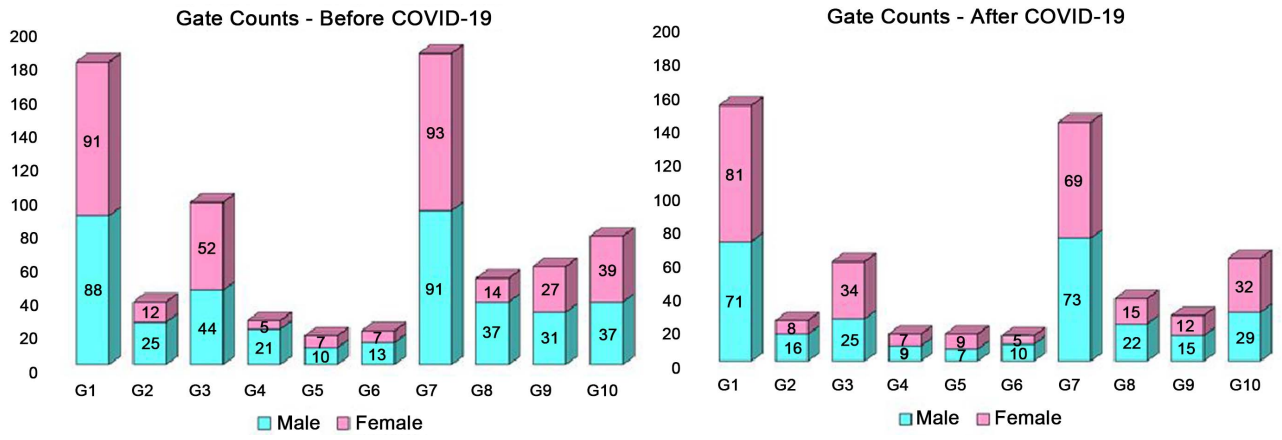
G: Gates – M: Male – F: Female – D: Day (D): (Thursday: D2. Friday) – T: Time (pm) (T1: start at 15 pm) T2 = T1 + 2 hours, T3 = (T1 + 2 hours.)

Table 2. Commercial spaces usage in green plaza mall before and after COVID-19.

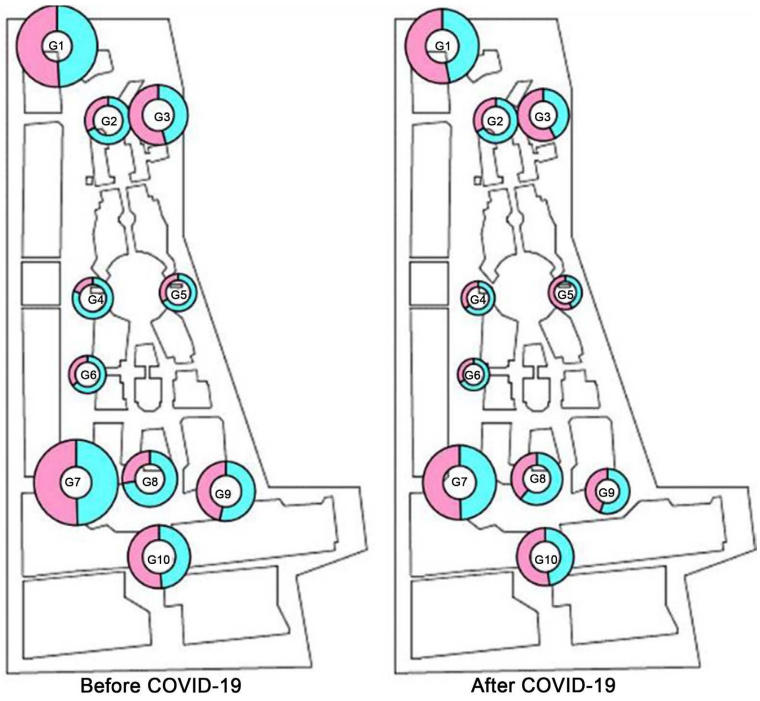
	Before COVID-19									
	Shops			Cafeteria			Restaurants			Others
	Total	Rented	Vacant	Total	Rented	Vacant	Total	Rented	Vacant	
Ground Floor	77	63	14	7	7	0	3	3	0	**Bank = 1 (rented)** **Kids Store = 2 (rented)**
First Floor	55	27	28	3	3	0	8	7	1	**Offices = 2 (rented)** **Food court = 1 (rented)**
Total	132	90	42	10	10	0	11	10	1	6

Continued

	After COVID-19									
	Shops			Cafeteria			Restaurants			Others
	Total	Rented	Vacant	Total	Rented	Vacant	Total	Rented	Vacant	
Ground Floor	77	15	62	7	7	0	3	3	0	**Bank = 1 (rented) Kids store = 1 (rented) + 1 (vacant)**
First Floor	55	9	46	3	3	0	8	7	1	**Offices = 2 (rented) Food court = 1 (rented)**
Total	132	24	108	10	10	0	11	10	1	6



(a)



(b)

Figure 4. Showing the graphs of the ratios of entry males and females at the ten gates before and after COVID-19 in green plaza mall.

As shown in Figure 5, the number of rented spaces at ground floor is higher than the rented spaces at first floor. Before COVID-19, the percentage of vacant spaces is less than 50% of commercial spaces. While after COVID-19, the percentage of vacant spaces is more than 50% of commercial spaces. However, as expected COVID-19 had great effect on the financial conditions of the shopping mall. Other design aspects have also great impact on rented percentage in the shopping mall such as the number of anchor points and the visibility of vertical circulation elements. These aspects required to be determined through studying the spatial configuration of the mall.

3.2. Computational Study

Using space syntax as computational method gives a second layer of understanding spatial configuration of green plaza mall. Space syntax method is based on theory developed in 1970s by Bill Hillier and colleagues at the Bartlett School of Architecture, University College London (Mohareb & Kronenburg, 2012). The theory and its applied method and tools focus on analysing the relation between the spatial configuration and socio-behavioural pattern (Hillier & Hanson, 1997). Hillier described that urban space as dynamic spatial model morphed through history rather than static spatial model holding spatial activities (Hillier et al., 2007). Thus, the spatial configuration has two-way continuous relation with the socio-behavioural pattern (Hillier & Iida, 2005). Space syntax as computational method can describe the pattern of movement and frequency of use within certain urban spatial configuration through four calculation studies.

The first two calculations which are connectivity and visual integration are considered Visibility Graph Analysis (VGA) in which it's a computation of multiple points in a system of spatial relations. VGA have shown the various attributes of visibility relations with the movement pattern and spatial perception potential of users in a system of spatial relations (Ozbil et al., 2018; Conroy, 2003; Campos, 1999). Firstly, connectivity in which can be defined as the visual relation between every space with its neighboring spaces. This is can be considered as a measure of the number of spaces that can be observed directly from point location (Bayoumi et al., 2021; Seçkin & Türkoğlu, 2010). Secondly, Visual Integration in which can be defined as the opportunity of space to be perceived from any surrounding visual point in the system. In other words, how certain space can act centrally to the entire spatial configuration system (Ozbil et al., 2018). Spatial integration is other concept related to visual integration which space can be defined as integrated or segregated. The highly integrated spaces mean that it requires the fewest steps to reach all other spaces in the system of spatial relations, while the most segregated spaces require the highest steps to access all other spaces in the system (Ozbil et al., 2018). Other term used is depth of space, high depth means high segregation of space and lowest depth means high integration of space.

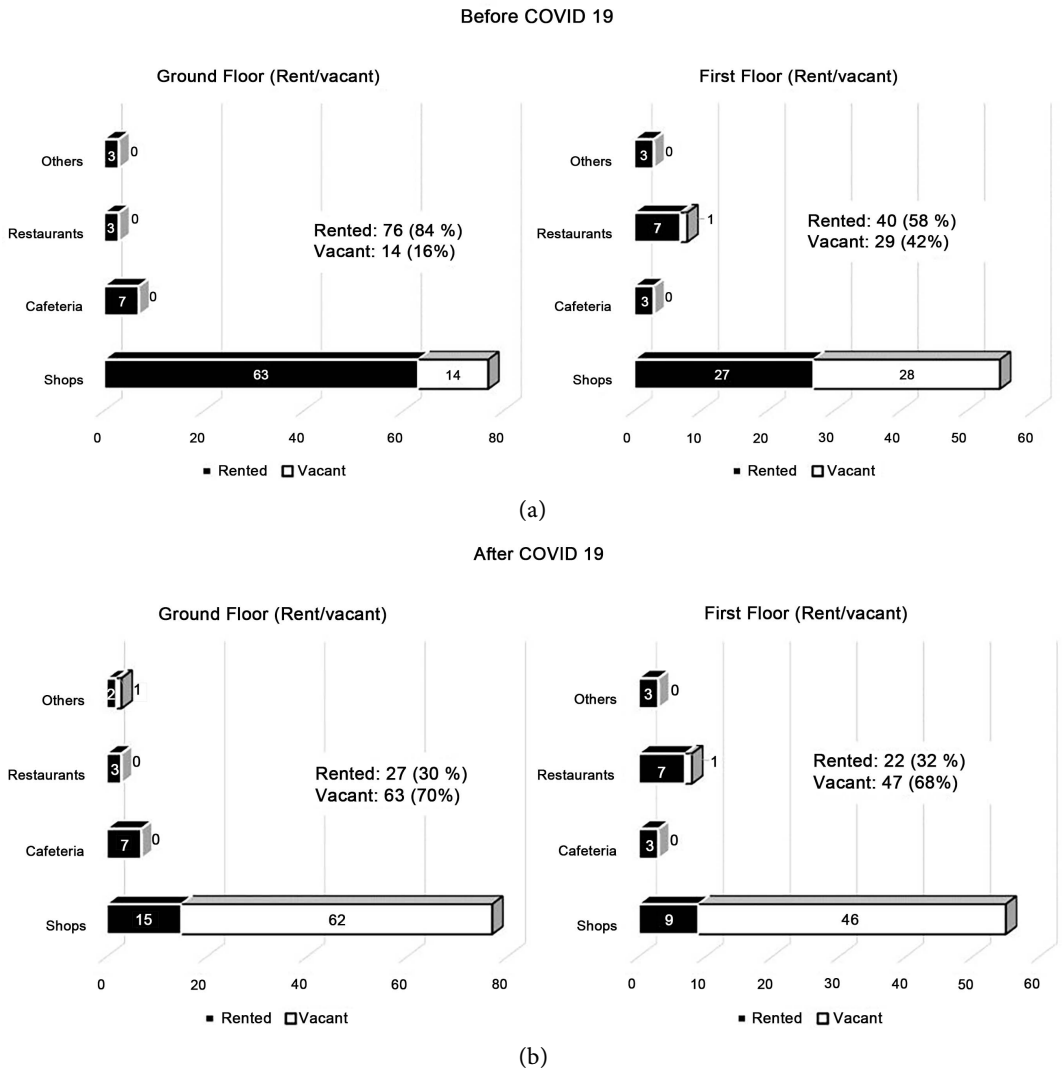


Figure 5. Graphs summarized the commercial spaces usage in green plaza mall before and after COVID-19.

Thirdly, gate counts (agent simulation) in which can be defined as a simulation of individual (agent) movement behaviour. As each agent distribute in the spatial system and choose their movement pattern based on determined visual field generated from the VGA. Therefore, agents are pre-computed of the visibility range from any points in the system. This study it allows social researchers to simulate the mostly likely movement pattern of individuals within certain spatial relations (Penn & Turner, 2001).

Finally, isovist study is an examination of users' range of view to spatial configuration. As an acting to real world space there are many obstacles that obscure the ideal isovist through "route vision profile" (Emo, 2014). This "route vision profile" which consists of a number of isovist points studies how isovists can vary along selected paths (Conroy, 2001). In the case of green plaza mall, isovist can analyze how much of shops and entry paths are viewed through selected

points within this route vision profile.

3.2.1. VGA: Connectivity and Visual Integration

In connectivity and visual integration study, three measurement rulers are used to have a clear viewing of the VGA grades of the UOS in the shopping mall. In connectivity study, the three measurement rulers used are 24 to 2400, 2000 and 1600 respectively as shown in Figure 6 and Figure 7. In visual integration study, the three measurement rulers used are 2 to 11, 10 and 9 respectively.

As presented in contour maps and box whisker plots in Figure 6, Figure 7 and Figure 8, At Ground Floor (GF), the average measured connectivity attribute is about 866.7 between minimum attribute of 22 and maximum attribute of 2049. The highest connectivity values are observed in the space in front of the cinema complex coded as UOS 5. At the ground floor, western axial Path 1 (P1) which include UOS 1, UOS 2 and UOS 5 have higher connectivity values than P2 and P3 and their UOS. At first floor, the average measured connectivity attribute is about 285.2 between minimum attribute of 8 and maximum attribute of 743. The highest connectivity values are observed in the space in front of the food court in the south zone of first floor corridors in which as coded as UOS 9.

As presented in contour maps and box whisker plots in Figure 9, Figure 10 and Figure 11, At Ground Floor (GF), the average measured visual integration attribute is about 7.19 between minimum attribute of 3.45 and maximum attribute of 11.65. The highest visual integration values are observed in the space in front of the cinema complex coded as UOS 5. At the ground floor, western axial Path 1 (P1) which include UOS 1, UOS 2 and UOS 5 have higher visual integration values than P2 and P3 and their UOS. At first floor, the average measured visual integration attribute is about 4.34 between minimum attribute of 2.02 and maximum attribute of 6.92. The highest visual integration values are observed in the space in front of the food court in the south zone of first floor corridors in which as coded as UOS 9.

The scatter plot values as shown in Figure 12 show that there is good correlation between visual integration and connectivity with R^2 of about 0.64. The highest difference between the two measures is indicated in southern eastern spaces in ground floor and in central spaces at first floor.

3.2.2. Gate Counts (Agent Simulation)

Agent simulation was run in the two floors to simulate the gate counts of simulated agents in the existed case of the mall. This study shows the number of steps can take for each grid according to 10,000 timestep as input data of analysis length and input of 0.1 as a release rate. As shown in Figure 13, the average gate counts value in the two floors is about 120.26 and the maximum gate counts in the study is 645. The entry selected points are indicated for the study to simulate agents. In this study, it was shown in Figure 14 and Figure 15 that there was relative similarity to connectivity and visual integration as the highest value of gate

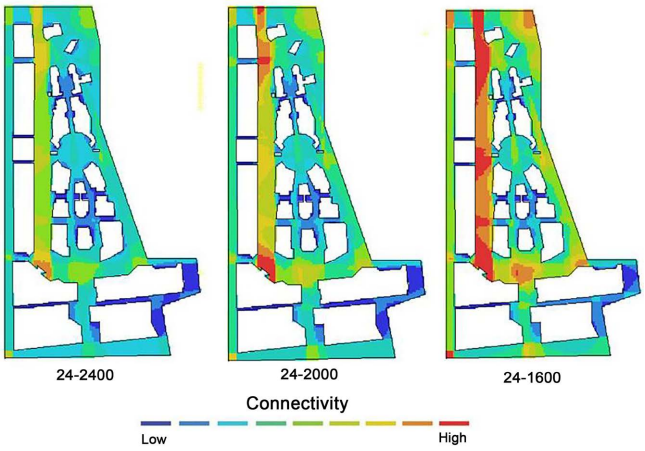


Figure 6. Connectivity study of Ground Floor (GF) through three measurement rulers (at maximum ranges of 2400, 2000 and 1600).

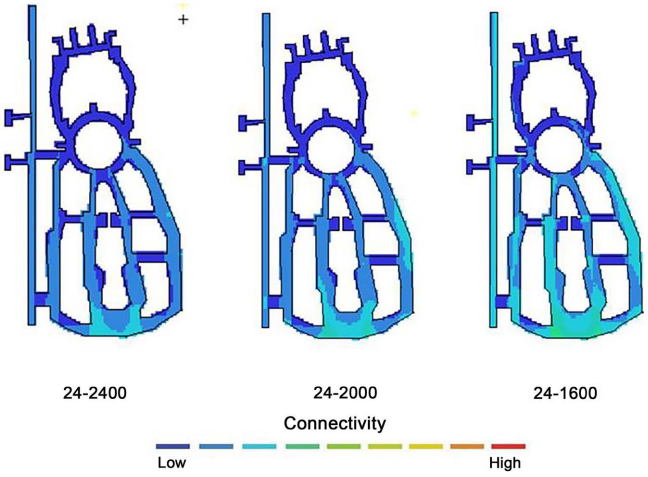
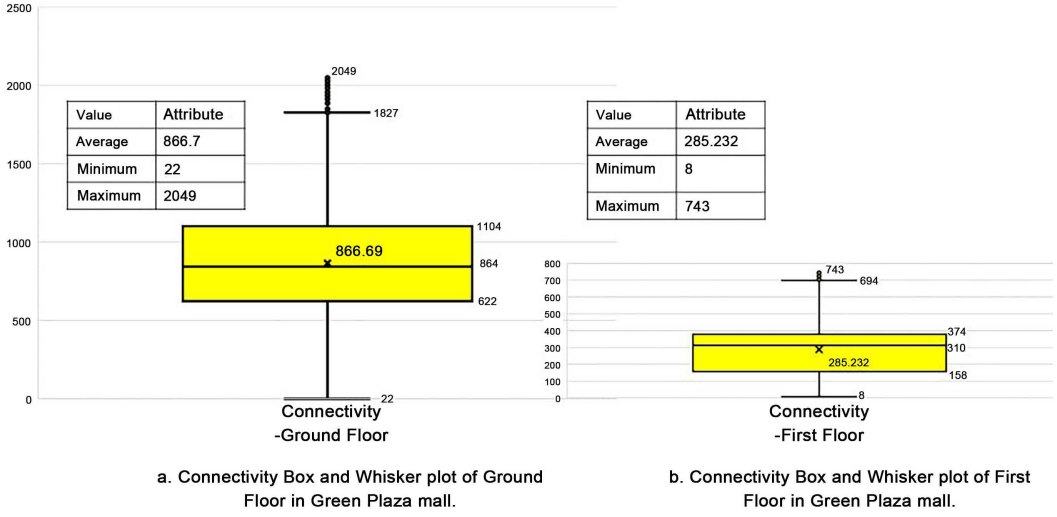


Figure 7. Connectivity study of First Floor (FF) through three measurement rulers (at maximum ranges of 2400, 2000 and 1600).



a. Connectivity Box and Whisker plot of Ground Floor in Green Plaza mall.

b. Connectivity Box and Whisker plot of First Floor in Green Plaza mall.

Figure 8. Connectivity Box and whisker plots of GF and FF.

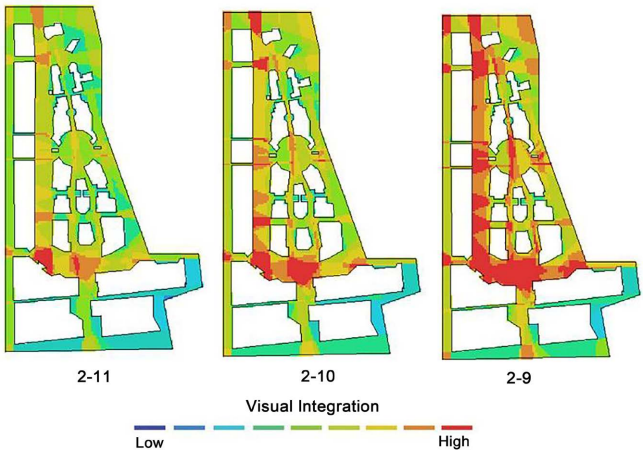


Figure 9. Visual Integration of Ground Floor (GF) through three measurement rulers (at maximum ranges of 11, 10 and 9).

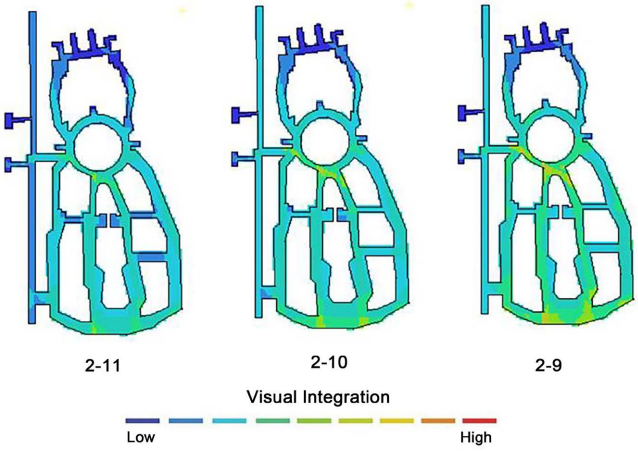
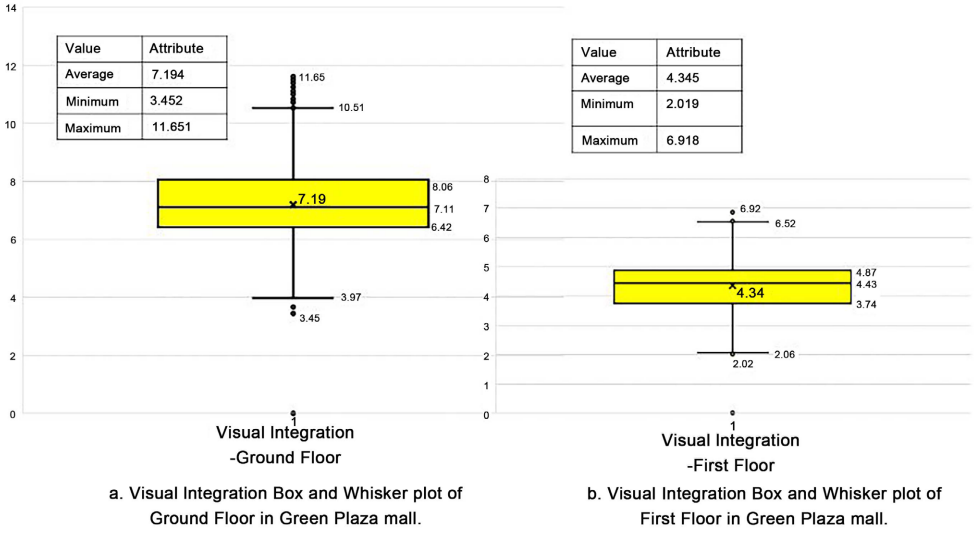


Figure 10. Visual Integration of First Floor (FF) through three measurement rulers (at maximum ranges of 11, 10 and 9).



a. Visual Integration Box and Whisker plot of Ground Floor in Green Plaza mall.

b. Visual Integration Box and Whisker plot of First Floor in Green Plaza mall.

Figure 11. Visual Integration Box and whisker plots of GF and FF.

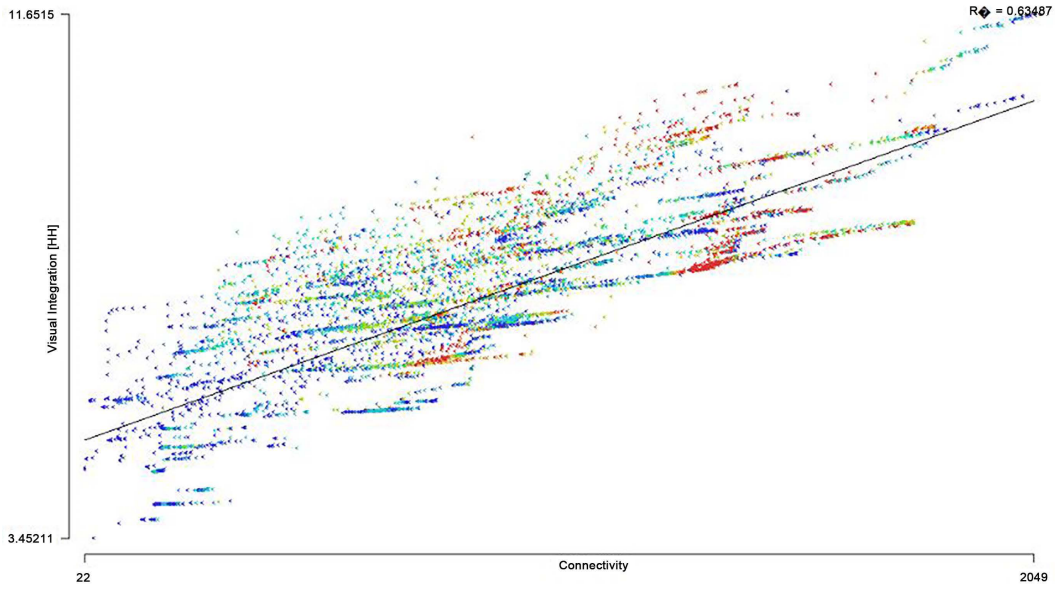


Figure 12. Scatter plot and correlation (R^2) between visual integration and connectivity values.

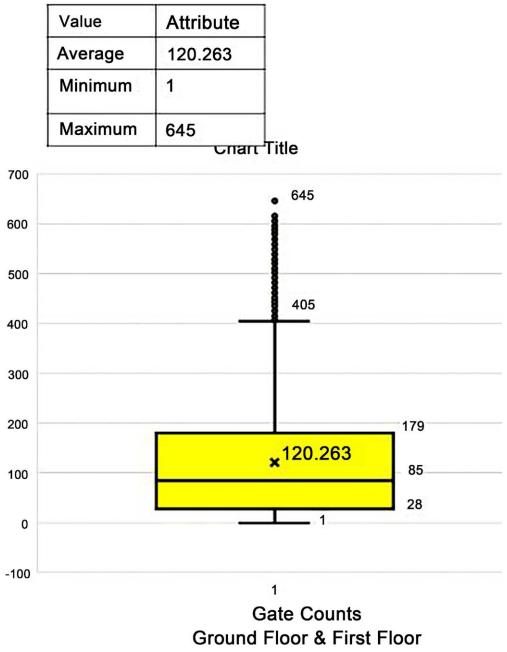


Figure 13. Gate counts Box and whisker plot of the two floors.

counts was in UOS 3, UOS 5 and UOS 1 respectively in ground floor, and UOS 9 at food court can have the gate counts in first floor.

3.2.3. Isovist

Isovist as part of space syntax analysis is used to examine visibility of space by users. According to Gibson (1979), in the study of environmental perception a moving observer is subjected to an ambient optic array which includes of variant

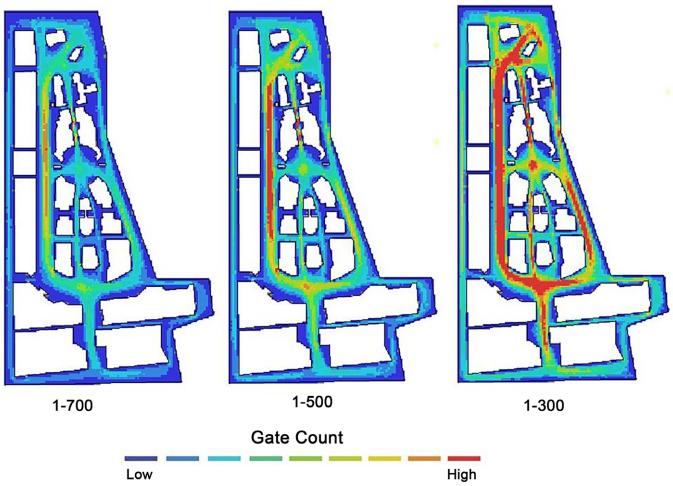


Figure 14. Gate counts of Ground Floor (GF) through three measurement rulers (at maximum ranges of 700, 500 and 300).

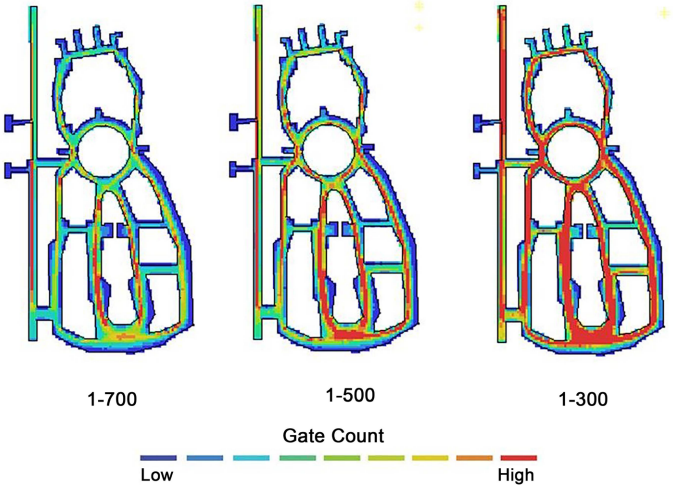


Figure 15. Gate counts of First Floor (GF) through three measurement rulers (at maximum ranges of 700, 500 and 300).

and invariant information. Isovist analysis used to measure invariant properties of the surrounding urban environment. Through isovist points sequence which indicate isovist fields that are overlapped and indicate the visual perception through the circulation in urban spaces. Conroy (2001) indicated this process as "route vision profile" in which indicates that isovist points can have individual properties that vary urban paths.

The study of environmental perception of green plaza mall spaces is done through optimal viewshed from selected points. Seven isovist points are indicated through main paths. The first three isovist points IV1, IV2 and IV3 are located at the western path (P1) started from the entrée of the shopping mall at the north and ended at the cinema complex at the south. Points IV4, IV5 and IV6 are located at the eastern path (P3) in which indicated as the secondary entrée path. Point IV7 is added at the southern part at the entrée of the kids playing

zone. The viewshed of each point is shown separately to know what can be seen from one point to another.

As shown in Figure 16, the first three isovist points show limited viewshed area. IV1 show the viewed area of northern elevations of the mall in which there is no vital entrée point to first floor. Next point IV2 show limited view to central circular space in which most of circulation elements to first floor. IV3 show well observed viewshed area to the UOS 5 in front the cinema complex.

The viewshed area of IV4 show that its vital point as visual linkage between path P1 and path P3. IV5 also is shown in Figure 17 as visual linkage point between path P2, P1 and the central circular space. IV6 is the isovist point which show well observed viewshed area at gate G7 in front of the cinema complex.

As shown in Figure 18, the last point IV7 added at route vision profile in green plaza mall. IV7 is shown as transitional point between different zone in which entrée circulation of food court in first floor can be observed, eastern and western spaces of cinema complex and hypermarket can be observed and also southern path to kids playing zone partially observed. The route vision profile of the 7 Isovist points shows that there is limited view to circulation points to first floor.

4. Conclusion & Discussion

This research has studied green plaza mall as one of the largest outdoor shopping malls in Egypt through social dimension and its effect financially on the mall before and after COVID-19.

However, green plaza mall considered important social hub in Alexandria, the results of observational and computational methods used in this study show many problems in the designed shopping mall which can be summarized as:

1) Limited number of Anchor spaces (Food court, Child Play zone, Open theatre, etc.): according to the large size of green plaza mall, the design of the mall should increase the number of anchor spaces specially at paths (P1, P2 and P3). This diversity of activities is vital to be distributed at important points such as courtyards, building corners to attract pedestrian flow and have higher social integration in public spaces.

2) Hidden vertical circulation elements: isovist analysis shows that the location of vertical circulation elements is not clearly observed in green plaza mall, as when vertical circulation unobserved in most cases this leads to less presence of users at first floor which leads to higher number of vacant shops at first floor.

3) Many hidden shops mainly at first floor: static snap shots of viewed spaces at first floor show that shops facades are hidden from the ground floor in which discourage visitors to be interested to get to first floor, which led to high vacancy rates in the first floor.

4) Limited number of wide access entrée spaces to central path (P3): syntactical studies show that however pedestrian prefers at entree wide access that lets building structures observable, but after a while in central zones, they prefer intimate small outdoor spaces which encourages social integrative activities.

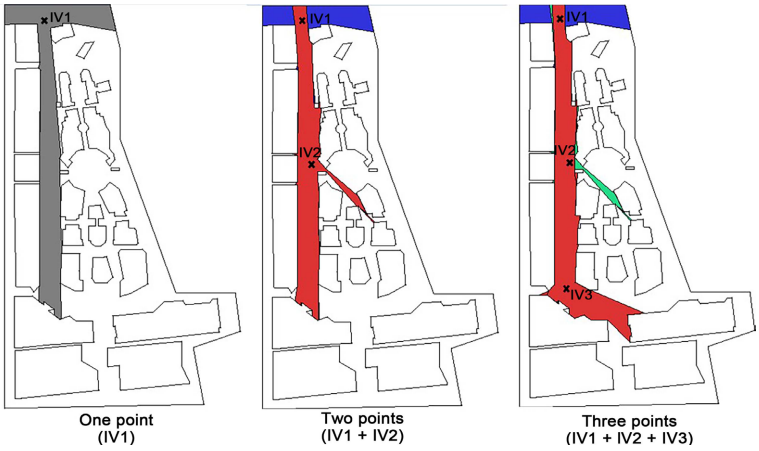


Figure 16. Isovist route vision profile through 3 points at western path (P1).

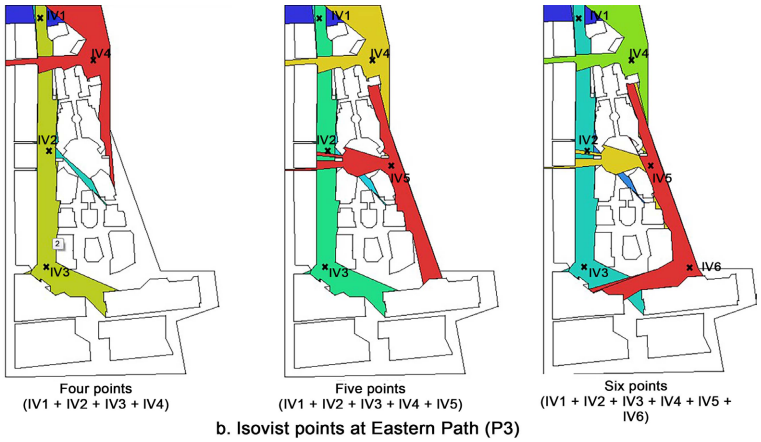
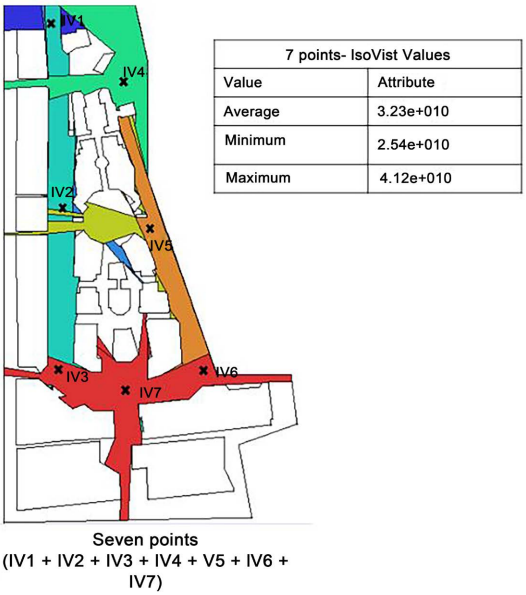


Figure 17. Isovist route vision profile through adding 3 points at eastern path (P3).



7 points- IsoVist Values	
Value	Attribute
Average	3.23e+010
Minimum	2.54e+010
Maximum	4.12e+010

Figure 18. Isovist seventh point and the summary table of the seven points attributes.

5) After COVID-19, there was a decline of visitors' presence at southern eastern gate G9: after 2 years of social distancing, social activities affected negatively even after these 2 years. UOS 5 in front of cinema complex and hyper market affected of this decline of social activities specially in front of hyper market at gate G9.

6) Decline in number of female visitors at central gates such as at G4 and G6: as observed as much as open spaces are not wide, not day lighted enough and not apparent enough to female visitors, it was considered unsafe for female visitors. Also in this study, it was female visitors that prefer warm south open spaces than western and eastern open spaces. This shows that however the presence of female-products shops concentrated mainly at central parts and first floor of the mall, and most female visitors prefer more warm social spaces specially at the southern and north eastern zone.

To sum up, high number of vacant commercial spaces after COVID-19 requires new design solutions such as increasing number of bridges between buildings can increase integration and have wide entrée open spaces at vertical circulation elements. For further research in future studies, it would require to examine the retrofitting design solutions proposed according to existing observational and computational studies to have effective post-COVID urban open spaces in green plaza mall.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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