

Space Syntax as a Tool to Enhance the Performance of El-Tahrir Complex Plaza

تقنيات تحليل بنية الفراغ كأداة لتحسين أداء ساحة مجمع التحرير

A. Abdelalim¹, H. Khalil², T. Sobhy³, and H. Farouk⁴

الملخص :

تعد الفراغات الحضرية العامة، بما في ذلك ساحات وسط المدينة متنفس للمجتمعات لممارسة الأنشطة المختلفة، حيث تساهم في تلبية العديد من احتياجات المستخدمين الوظيفية والاجتماعية والنفسية.

وتعد ساحة مجمع التحرير من أهم ساحات وسط مدينة القاهرة، والتي بالإضافة الي كونها متنفس للمناطق المحيطة فهي تعد مسرحا للعديد من الأحداث السياسية، إلا أنه نادراً ما تستخدم الساحة إلا كساحة انتقالية للأشخاص الذين ينتقلون من مكان إلى آخر ولا يبدو أنها تلعب أي أدوار تتجاوز ذلك.

يهدف البحث إلى دراسة العلاقة التبادلية بين خصائص التكوين المكاني للساحة وسلوك المستخدمين وأثرها على فعالية الأنشطة داخل تلك الساحة، من خلال رصد المشكلات التي تسبب تشتت سلوك المستخدمين داخلها. تم استخدام تقنيات تحليل بنية الفراغ وطرق الملاحظة المختلفة وهي تعداد المستخدمين وتتبع حركة الناس لتحديد الخصائص المكانية لحالة الدراسة من خلال قياس قيم إمكانية الوصول والرؤية للساحة.

أظهرت النتائج أن خصائص التكامل والاختيار والتكامل البصري عوامل مهمة من حيث تأثيرها على زيادة الأنشطة البشرية في الساحة، وعليه يمكن استنتاج وجود علاقة بين السلوك البشري والمكاني في ساحة مجمع التحرير من خلال مطابقة نتائج عملية الملاحظة والخرائط المكانية. ، يتضح مما سبق أن تقنيات تحليل بنية الفراغ تعد أداة حيوية يوصي بإستخدامها لدراسة وتحسين أداء الساحات الحضرية بالمدن. عن طريق اختبار المقترحات التصميمية والمفاضلة بينها .

Keywords: Plazas, Human behavior, Space Syntax, El-Tahrir Complex Plaza

1. Abstract:

Urban public spaces, including downtown plazas, are important for communities, as places to practice different activities that help meet users' functional, psychological and social needs. El-Tahrir Complex Plaza is one of the most important downtown plazas in Cairo, due to its strategic location. However, few people use the plaza for activities except as a transitional space for people crossing it on their way from a place to another, and does not seem to play any roles beyond that.

1 Teaching assistant, Department of Architecture, Faculty of Engineering, Egyptian Russian university

Ava-mmahmoud@eru.edu.eg

2 Professor, Department of Architecture, Faculty of Engineering, British university in Egypt

hussam.bakr@bue.edu.eg

3 Assistant Professor, Department of Architecture, Faculty of Engineering, Mattaria, Helwan University

jardinogrouptwo@gmail.com

4 Assistant Professor, Department of Architecture, Faculty of Engineering, Mattaria, Helwan University

Heba_farouk@m-eng.helwan.edu.eg

Therefore, the study aims to investigate the interrelationship between spatial configurations of El-Tahrir Complex Plaza and users' behavior. In other words, this study investigates the impact of plazas' spatial configuration on user's activities within the plaza, aiming to identify physical and syntactical aspects that affect users' behavior, and led to space underutilization, and dispersal of users within the plazas.

Space Syntax techniques were used along with various observational methods, including gate counts, and movement traces to identify the spatial and social properties of the plaza by measuring the accessibility and visibility values.

By superimposing observation maps onto syntactical maps, the results showed that integration correlates strongly with pedestrian movement, and that visual integration correlates moderately with static activities, indicating that syntactic measures are a good predictor of human behavior. Thus, Space Syntax can become a vital tool for urban designers aiming to enhance utilization of urban plazas. Accordingly, a number of design alternatives were tested and compared and an alternative was chosen for its likeliness of improving space utilization.

2. Introduction:

Urban public spaces are main elements of the urban built environment, which have always played an important role in the city's structure, organization, and public life.

Plazas are one type of open public space, several spatial properties that contribute to a successful and lively plaza have been mentioned in literature, yet, impact of many important "syntactic" properties are neither adequately investigated nor understood. Therefore, it was found necessary to understand plaza's functionality in the Egyptian context by investigating one of the most prominent plazas in Cairo, namely El-Tahrir Complex Plaza, to understand how plaza's layout design affects its use, and how to make it more functional.

2-1-Research Problem and Questions:

Although El-Tahrir Complex Plaza is well known, observation showed a scarcity of human activities within the plaza, except for pedestrians crossing the plaza in their way to and from El-Tahrir Complex. This is believed to be due to reasons related to its layout and site organization. Therefore, the research tries to answer the following questions:

- a. Does the spatial configuration of El-Tahrir Complex Plaza affect users' activities and behavior?
- b. What actions can be taken to enhance the design and utilization of the plaza?

This study argues that certain syntactic characteristics, especially integration, affect the way people use the plaza.

2-2-Research Objective:

The study aims to identify aspects that contribute to the plaza's underutilization and to suggest interventional actions to enhance its utilization.

3. Literature Review:

Many studies have discussed the importance of public spaces, especially plazas and squares for societies, and have dealt with the impact of plazas on human behavior and the factors that promote efficient use of plazas. Husnéin (2017), stated that "everyday life is connected to urban design, through everyday experiences of physical space"¹. Urban space is essential for what people can do within it².

Plaza is predominately hard-surfaced, outdoor public space, usually connected to the building that excludes cars. It serves a number of activities such as strolling, sitting, eating, and watching the world go by unlike a sidewalk, it's a place to gather rather than a space to pass through.³ Plaza is one of the most important urban elements of city design. Plazas are microcosms of urban life, offering excitement, markets, and public ceremonies, a place for meeting, resting, and watching; they are usually shaped by users' needs, and topography.⁴

Plazas' form and function are equally crucial, as the success of the urban plazas are determined by the effective interplay between these two elements.⁵

Plaza's functionality is affected by many aspects. William White is among the pioneers who studied the performance of plazas, as he noticed that many urban public plazas are underutilized, or improperly used, due to design deficiencies that are mainly related to their layout and site organization.⁶

Whyte, (1980) observed and recorded human activities at 18 plazas in New York City and discovered that people preferred spaces full of users, pedestrian paths, sitting areas, retail frontage, food facilities, and orientation (southern exposure where possible and maximum sunlight). He deduced that the main activity for people is to look at other people, and that what attracts most people, are other people, and concluded that visibility increases the sense of security that is highly preferred by people.⁷

Campos, B. (1997) conducted a comparison between twelve plazas in London, focusing on spatial properties of closure (visual link with the surroundings), syntactic measures, and the number of static people using the plazas. The results showed that the performance of plazas is related to the provision of places to sit, and physical elements. It was also found that the number of static people using the plaza is not only dependent on the number of axial lines that interface with the public space, but on the sum of its global and local integration values.

In another study, Campos & Golka, (2005) investigated the relationship between visual fields and patterns of stationary activities in six public plazas in London. The results indicated that people avoid very exposed areas and prefer spaces providing views, so the need for the ability to see is present, but the degree of seclusion depends on the person himself.⁸

Bada (2012) has investigated four plazas in Biskra, Algeria's city center, to see why some portions of the plaza are livelier and more popular than others. He looked at the

link between people's movement and the spatial usage of the visual fields formed by the spatial arrangement. People pick a place that provides some seclusion, according to the findings, therefore spatial use is closely linked to visual aspects relevant to the sort of activity.⁹

In their quest to improve the quality of the public realms in Trafalgar Square in London, that was perceived to be unpleasant, unsafe, and dominated by traffic, researchers at Space Syntax Ltd. London and the Space Syntax Laboratory at the University College London undertook detailed counts of pedestrian flows in several central areas in London, correlated them with various syntactic measures, and consistently found that the higher the numerical integration value, the greater the number of people in the streets. This knowledge allowed the prediction of how the urban design proposal for Trafalgar Square might increase or decrease the presence of people for each path¹⁰. Since its renewal, the square has become an important meeting place for tourists as well as for locals, as it improves accessibility to the square and directs pedestrian flow through the square instead of around it.¹¹

Several studies have obtained pedestrian movement and it has been proven that there is a relationship between pedestrian movement and integration maps.^{12& 13} Thus, Space Syntax method can thus help in reaching an optimal solution to spatial challenges, through predicting the behavioral impacts of urban planning and design proposals.

4. Research Methods:

In the study, two types of research methods were used to study the spatial, and social characteristics of El-Tahrir Complex Plaza: 1. Observations, 2. Syntactic analysis.

4.1. Observational Methods:

Observation methods were used to describe the rates of pedestrians and activities within different spatial configurations, by analyzing static snapshots, movement traces, and gate counts.

- **Movement traces:** It allows for the tracking of people's movement and behavior within spatial configurations by monitoring their movement from the beginning to the conclusion in order to find areas that attract movement and crucial elements influencing movement.
- **Static Snapshots:** It's usually done to record the pattern of using public spaces. It is used to monitor stability activities or to monitor movement, in which the observer is standing in a place that allows him to see the scene in full and clear to record these shots to identify and know the effective spaces within the area and the ineffective ones.
- **Gate Counts:** This method depends on the observer who selects a location within a movement path and counts passers-by or pedestrians for about 5 minutes, then determines the number of passers-by in an hour, usually selects 15 gates or more

for observation. The counts of movement are usually helpful in understanding the relationship between spatial structure and human behavior.

4.2. Syntactic Analysis:

The Space Syntax Approach is developed to help designers simulate the potential effects of their designs on users' behavior, during their use of buildings, urban spaces, or settlements.¹⁴

Space Syntax provides a practical framework for investigating the relationship between man and the built environment as well as methods for describing spatial configuration at local and global levels.¹⁵ Space Syntax deals with spaces as a system where physical aspects are inseparable from the social ones.¹⁶

'Depthmapx' application version 0.8, is a software developed by Tasos Varoudis that provides syntactic analyses for different types of internal and external spaces, including plaza and square layouts, by generating different types of syntactic maps including all line maps, and visibility graph analysis, accompanied by a wide range of measures that were repeatedly found to correlate with different forms of human activities.

The most important Space Syntax measurements are:

- **Choice:** is a measure of the through-movement potential of linear structures.¹⁷
- **Integration:** is a measure of accessibility for each space in the spatial system.¹⁸
- **Visual Integration:** is a measure usually indicative of how many people are likely to be in space and is thought to correspond to rates of social encounters and retail activities.¹⁹

5. Case Study:

5.1. Criteria of Case Study Selection:

El-Tahrir Complex Plaza was based on the following criteria:

- 1- The plaza is strategically located at the city center, at one of the busiest areas of Cairo city.
- 2- The plaza is part of El-Tahrir Square is prominent worldwide, as it played an important role in the 2011 revolution.
- 3- The plaza is close to important landmarks, as it is attached to El-Tahrir Complex administrative building, close to Helton Ramses Hotel, and ANL (Arab Nations league), and to the Egyptian Museum, the American University in Cairo, and to Nile River.
- 4- The researchers` noticed during their repeated visits to the plaza a change in users' behavior and movement patterns than before (there is a limited number of individuals who may enter the plaza to enter El-Tahrir Complex building, and pedestrians avoid the plaza).

5.2. El-Tahrir Complex Plaza Description:

The plaza is located in Cairo Governorate's downtown area. Because it is located in front of an important administrative building (El-Tahrir Complex), it is an administrative plaza with a rather irregular architectural shape, adjacent to El-Tahrir Square, in the heart of Khedive Cairo, near the Egyptian Museum, and the old American University. It is surrounded by a network of main streets making it easy to reach. The plaza combines softscape (grass, tree, and palm) and hardscape (seats, pathways, lighting units, fences, and signs).

The plaza is split by the main walkway into two zones: 1. North eastern triangular-shaped zone, adjacent to Tahrir roundabout and Al-Qasr al Aini street. This zone is predominately green split by three parallel minor walkways; 2. The second zone is closer to El-Tahrir complex building, with more hardscape, a central circle, and radial walkways, as shown in Fig. 1

The plaza is surrounded by Fences that prevent pedestrians from passing through it, except from few entrances, which leads to an increase in the movement of pedestrians outside the plaza. All the green spaces in the plaza are surrounded by low fences, to discourage pedestrians from using them. There are some benches in the plaza, that allow the plaza to be used as seating areas. Due to its proximity to the Omar Makram Mosque and the American University, few pedestrians use the plaza during the day, especially near the two metro exits inside the plaza, yet the number of users dropped at night due to security considerations. Fig. 2 show plaza arrangement.

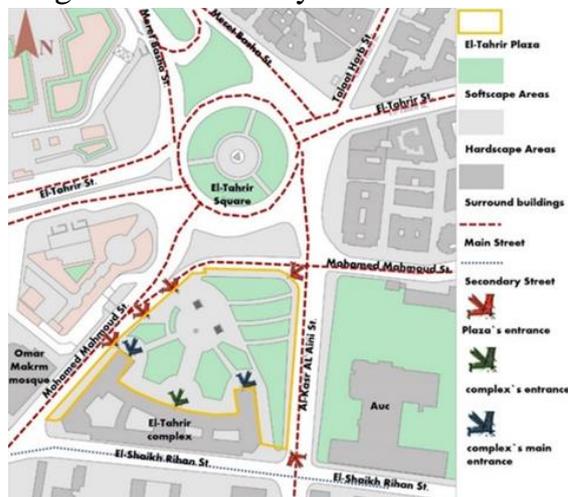


Fig. 1 Spatial Configuration of El-Tahrir Complex Plaza, Source: Author

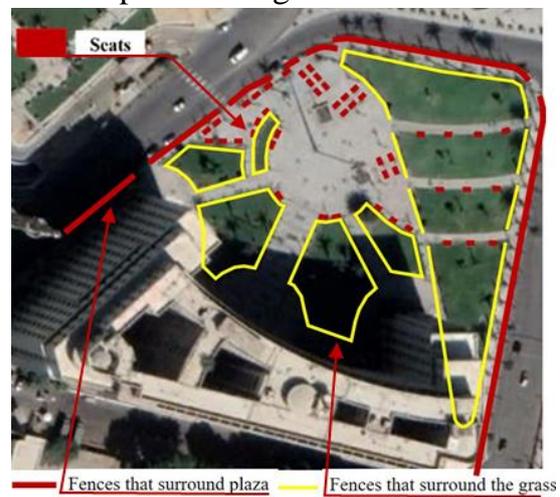


Fig. 2 Furniture in El-Tahrir Complex Plaza, Source: Author

6. Improvement Process of El-Tahrir Complex Plaza:

Several steps were used to create a framework for enhancing the performance of the El-Tahrir Complex Plaza, guided by the literature review, and by using Space Syntax analytical techniques in the following three phases:

- 1- Studying and analyzing the current situation by observing current uses (movement and static), identifying problems, and detecting whether or not the current use is related to any physical or syntactic measures.
- 2- Analysis of the entire plaza as if it is empty, by removing all internal and external physical elements and obstacles (fences, seats, signs, pathways, etc.), to have a better understanding of the Plaza's spatial properties.
- 3- Proposing and testing different redesign alternatives to enhance the performance of Plaza, using Space Syntax.
- 4- Comparing alternatives, and identifying the alternative that is likely to enhance Plaza's usability.

6.1. Analysis of the Existing Layout of El-Tahrir Complex Plaza:

At this stage, the researchers rely on observational methods of behavior (movement traces, static snapshots, and gate count), and syntactical analysis of the existing plaza layout. The behavioral measures were then correlated with different syntactic measures to understand the impact of the current design on users' behavior.

6.1.1. On-site Observations

Methods are represented in the following:

6.1.1.1. Movement Traces:

Movements were tracked for a number of pedestrians who were randomly chosen, where a pedestrian is tracked as he enters the plaza and surrounding area from one point until he leaves the plaza or the square. Tracking sessions took place in two days, one weekday, and one weekend, at two different times of the day, with an average of 20 people at a time. The map of Fig. 3 indicates overlapped paths of these tracks. It shows that few pedestrians cross the plaza, except for those entering El-Tahrir complex.



Fig. 3 The Effects of Movement Pattern Through the Plaza, Source: Author

6.1.1.2. Static Snapshots:

People using the plaza for activities other than walking was observed on two different days - one weekday, and one weekend - at two different times of the day (day and night), by defining 15 virtual points through which users are observed and the results showed:

During the day the majority of the static activities' snapshots are represented in large proportions at the entrance to El-Tahrir Complex Plaza, as well as at the entrances, and exits of the metro station, passenger entry and leave, and seats are one of the benefits of the plaza throughout the day for seating.

Nighttime the majority of the static snapshots depict the metro station for passenger admission and exit, with no activity taking place inside the plaza owing to security and political concerns. as shown in Fig. 4

6.1.1.3. Gate Counts:

Numbers of pedestrians crossing the virtual gates was counted at different times of the day (at ten o'clock in the morning, at one o'clock, at three o'clock, and 6 o'clock in the afternoon), and the results showed:

Observation showed that the number of visitors to the El-Tahrir Complex building increases at ten o'clock, in the afternoon, the numbers increase at the entrance to the Omar Makram Mosque to perform prayers, at one & three o'clock, and the number of users decreases significantly due to some security factors, and the numbers increase only in the surrounding of the plaza, at six in the evening. as shown in Fig. 5

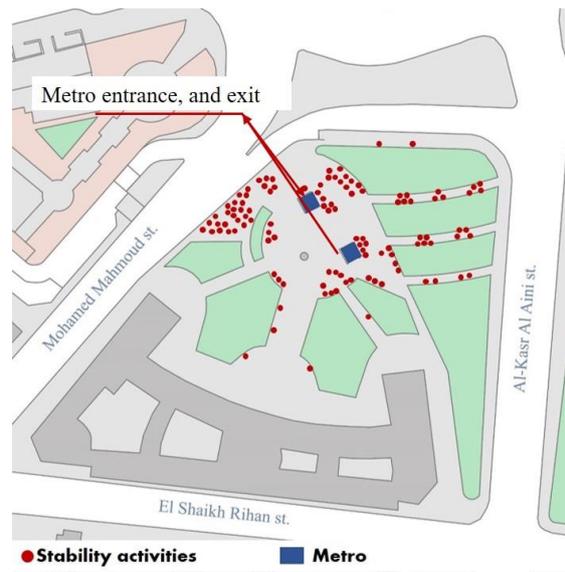


Fig. 4 Collective Static Snapshots of El-Tahrir Complex Plaza, Source: Author

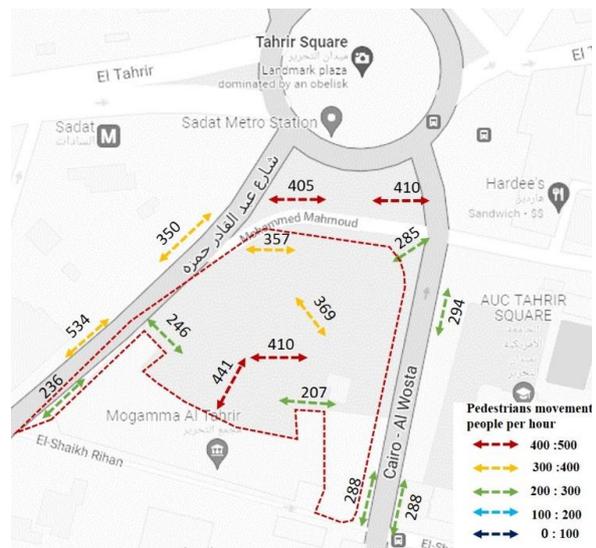


Fig. 5 A map showing the average number of pedestrians per hour observed in El-Tahrir Complex Plaza, Source: Author

6.1.2. Syntactical analysis of Existing EL-Tahrir Complex Plaza:

Syntactical analysis involves creation of AutoCAD maps for the current situation which was then imported into Depthmap to create different types of syntactic maps. Since previous studies indicated that visual integration is more related to activities, and (integration, and choice) are related more to movement, visibility maps and all all-line map were generated. All line map was considered more suitable than simple axial map for studying open spaces, as simple axial map is more suitable for studying of streets. These maps are shown in Fig. 6, and will be explained in the following:

6.1.2.1. Integration Map:

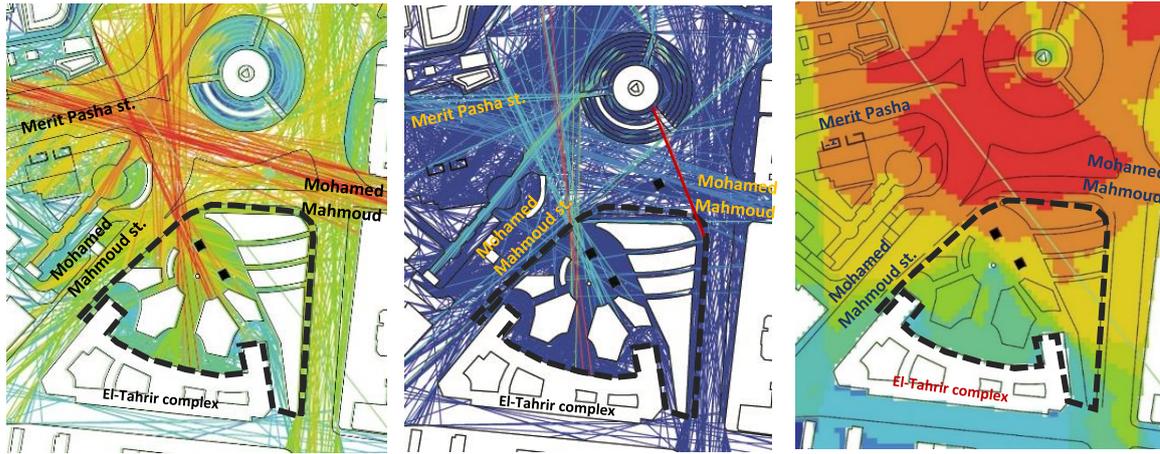
Analysis of the all-lines integration map shows that the high integration values appear in the main streets surrounding the plaza, especially El-Tahrir Street, Mohamed Mahmoud Street, and Merit Pasha Street. The main access point of El-Tahrir Complex Plaza records high integration values, and the integration map shows that the most integrated axial lines pass just beside the plaza, and only few integrated lines pass through the plaza. This suggest that the pedestrians would rather pass beside the plaza rather than cross it while moving from a place to another, except for those going to the metro station or for entering El Tahrir building. Correlational analysis would confirm this.

6.1.2.2. Choice Map:

Analysis of the all-lines choice map shows that El-Tahrir Complex Plaza has the highest choice value in the distance between El-Tahrir Square and the Plaza, Some of the average values pass within El-Tahrir Complex Plaza, although it is possible separate from its surroundings.

6.1.2.3. Visual Integration Map:

Analysis of the visual integration of El-Tahrir Complex Plaza indicated that the plaza lies just outside the most integrated part of the square (the red area). Yet, the north eastern part of the plaza (area in orange and yellow) have significantly higher visual integration values than the area near El Tahrir complex, which appear in green and blue indicating low integration values. This suggests that the north eastern section is has more visually accessible, and thus has more potentiality for human activities than the rest of the plaza.



a. Integration map

b. Choice map

c. Visual integration map

Fig. 6 Syntactical Maps of El-Tahrir Complex Plaza, processed by DepthmapX 0.8, Source: Author

By superimposing the observation maps on syntactic maps the following became clear: as shown in Fig. 7

- Movement of pedestrians through and around the plaza almost coincides with the all line integration map, particularly along the quite strong east-west integration axis. Pedestrian movement also followed another, yet weaker north-southern integration axis that lead to the complex building entrance. Statistics analysis indicated the presence of a significantly strong correlation between pedestrian count with integration ($r=0.774$), and choice ($r=0.533$). However, multiple regression analysis involving both integration and choice excluded choice from the equation, indicating that about 60% of pedestrian movement in a space can be predicted from axial integration alone. No significant relation was found between pedestrian count and visual integration. Table 1 shown the correlations between Gate Counts and Syntactical Maps

		Gate Counts	Integration	Choice	Visual Integration
Count	Pearson Correlation	1	.774**	.533*	.085
	Sig. (2-tailed)		.001	.041	.762
	N	15	15	15	15
Integration	Pearson Correlation	.774**	1	.839**	.194
	Sig. (2-tailed)	.001		.000	.489
	N	15	15	15	15
Choice	Pearson Correlation	.533*	.839**	1	.075
	Sig. (2-tailed)	.041	.000		.791
	N	15	15	15	15
Visual Integration	Pearson Correlation	.085	.194	.075	1
	Sig. (2-tailed)	.762	.489	.791	
	N	15	15	15	15

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Table 1 Correlations between Gate Counts and Syntactical Maps of El-Tahrir Complex Plaza, Source: Author

- Majority of stationary people group in visually integrated zones of the plaza, with significantly fewer people group in the less integrated spaces (green and blue areas), suggesting that the visual integration map is in accordance with the density of stationary users. and in areas where seats are available The areas near the entrances to El-Tahrir Complex are less integrated, and also the fewest number of users through observation, due to unavailability of seats.

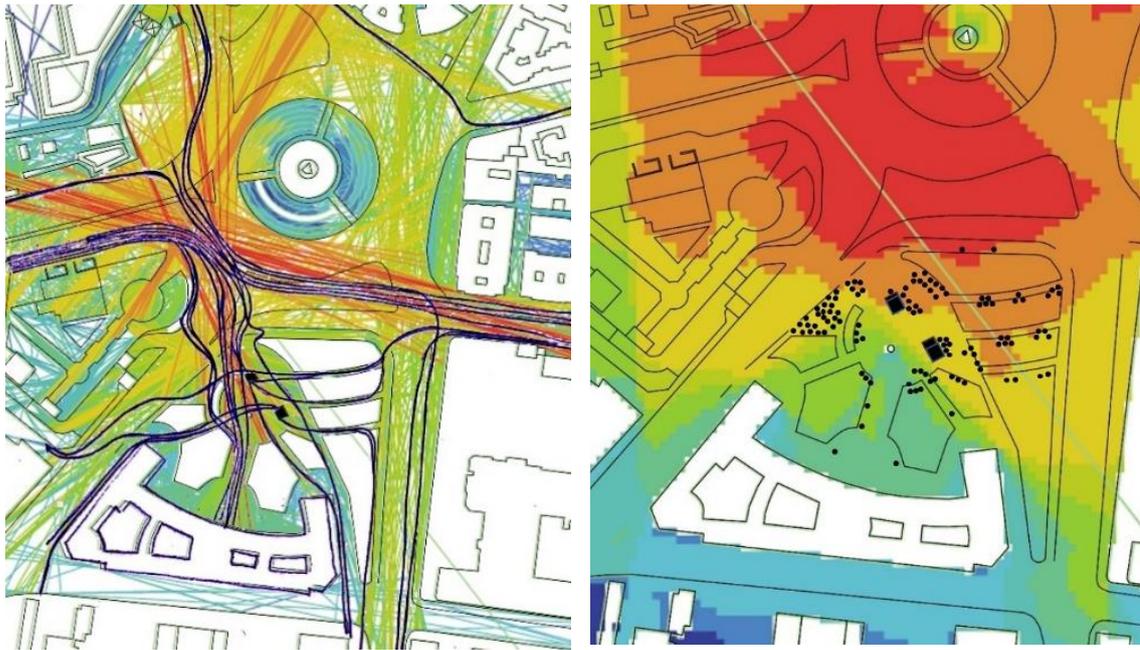
Statistical analysis indicated moderate significant correlation between people static activities with axial integration ($r=0.596$) and visual integration ($r=0.435$). This is a bit surprising, as static activities are expected to be related more to visual integration than to axial integration. Yet another surprising finding is that quite strong correlation do exist between seat numbers and static activities ($r=0.855$), which at first glance might suggest that seat numbers alone is the sole predictor of activities intensity. A closer look at the relationship between seats numbers and syntactic measures indicated a strong correlation between seat numbers with axial integration ($r=0.625$), and visual integration ($r=0.464$). This suggests that seats are more located along axially strong integrated locations than on visually strong integrated locations, that the result might change if more seats are to be located in areas of higher visual integration, and that activities might increase accordingly. Table 2 shown Correlations between Static Snapshots, seats, and Syntactical Maps

		Static Snapshots	Visual Integration	Integration	Choice	Seats
Static	Pearson Correlation	1	.435*	.596**	.001	.866**
	Sig. (2-tailed)		.034	.002	.995	.000
	N	24	24	24	24	24
Visual Integration	Pearson Correlation	.435*	1	.497*	.285	.464*
	Sig. (2-tailed)	.034		.013	.177	.022
	N	24	24	24	24	24
Integration	Pearson Correlation	.596**	.497*	1	.473*	.625**
	Sig. (2-tailed)	.002	.013		.020	.001
	N	24	24	24	24	24
Choice	Pearson Correlation	.001	.285	.473*	1	-.041
	Sig. (2-tailed)	.995	.177	.020		.849
	N	24	24	24	24	24
Seats	Pearson Correlation	.866**	.464*	.625**	-.041	1
	Sig. (2-tailed)	.000	.022	.001	.849	
	N	24	24	24	24	24

*. Correlation is significant at the 0.05 level (2-tailed).

**.. Correlation is significant at the 0.01 level (2-tailed).

Table 2 Correlations between Static Snapshots, seats, and Syntactical Maps of El-Tahrir Complex Plaza, Source: Author



a. Integration map and movement traces b. Visual Integration & Static snapshots

Fig. 7 Overlapping Observation and Syntactical maps, Source: Author

Based on the above analysis, the following diagnosis can be concluded:

1. Integration is strongly correlated with pedestrian movement in and around the plaza. Yet, the plaza is not part of the integration core, which passes just outside the Plaza boundaries. The fences that currently surround the plaza contributed to isolating the plaza from the nearby integration core, which is the main axis of pedestrian flow, and thus discourages pedestrians from crossing the plaza in their way to different destinations, except for those whose destination is the El Tahrir complex.
2. The main pedestrian passage split the plaza into two zones: north-eastern more integrated zone suitable for activities of the general public, and southern less integrated quitter zone, suitable as seating area for Complex building visitors. The more integrated northeastern zone is not designed to accommodate activities as it is planted with grass, surrounded by fences implying that people may not use them.

Design guidelines:

Based on the above diagnosis, the following guidelines were proposed to guide development and evaluation of different design alternatives.

1. To increase pedestrian movement through the plaza, we need to find a way to have the integration core pass through the plaza.
3. To increase activities, number of seats need to be increased, particularly at the areas of high visual integration values.

4. The north-eastern green area needs to be hardscaped, and furnished with more seats.
5. Addition of shades would encourage more people to use the plaza during the day.

6.2. Analysis of El-Tahrir Complex Plaza after removing physical and visual obstacles:

In this analysis, the entire square was treated as one single space. All physical elements that obstruct access or visibility of the square were removed to identify the naturally occurring accessibility pattern and to find out if the plaza lies within the integration core or not.

- **Integration Map:**

The integration map in Fig. 8 indicated that as a result of removing all the physical obstacles surrounding the plaza, the integration core clearly and naturally passes diagonally through El-Tahrir Complex Plaza. It can be concluded from this analysis that to encourage pedestrians to pass through the plaza, we just need to leave that axis open. This would increase number of passersby through the plaza, and would accordingly increase activities within the plaza if properly designed, furnished, and provided with amenities.

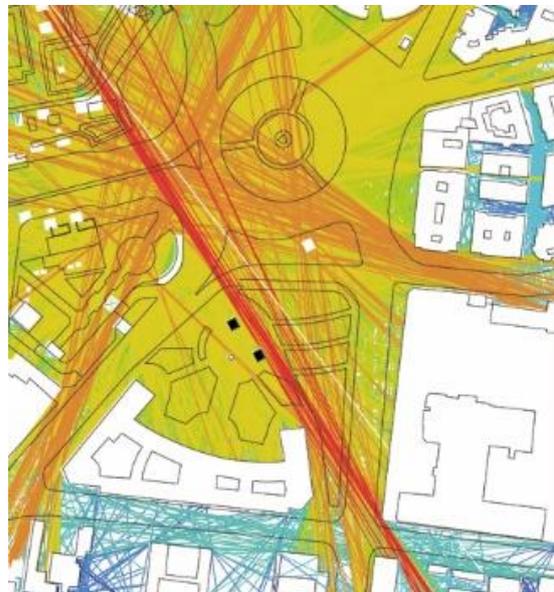


Fig. 8 Integration Map Without Physical elements, processed by DepthmapX 0.8, Source: Author

6.3. Implementation of The Analysis Results in Plaza Design Proposal:

Following the current status analysis and analysis after removal of all physical and visual obstacles, the following two alternatives were proposed, compared, and evaluated in order to predict which alternative would most likely encourage more use.

Because El-Tahrir Complex Plaza is spatially inseparable from El-Tahrir Square, any change in square design would affect plaza usage pattern, alterations were not restricted to the plaza but extended to the entire square. The alternatives are explained below.

6.3.1. The First Alternative:

This alternative seeks to preserve to some extent the original design of the plaza with a slight change in the fences openings. The width of the entrance and exit of El-Tahrir Complex Plaza was enlarged. The plaza was divided into two parts, one near the complex for gathering of its visitors, and the other at the north-eastern corner of the site for the activities of pedestrians in general. Some changes were made to El-Tahrir square. The rest of the square spaces was preserved. as shown in Fig. 9

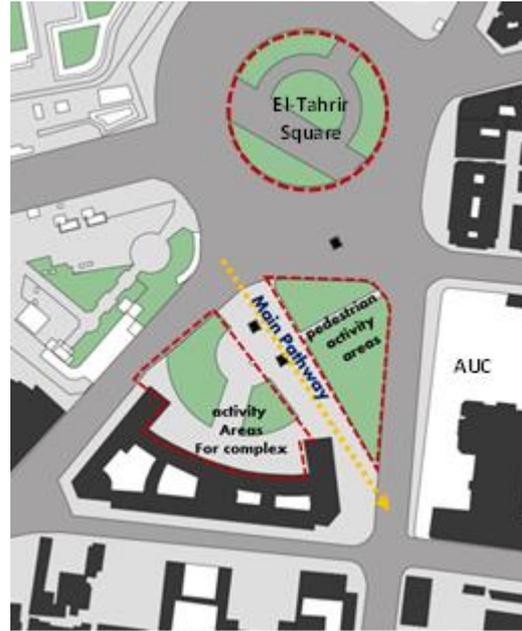


Fig. 9 The First Alternative Layout, Source: Author

By testing this alternative, the following was apparent:

Two integration cores intersect above the plaza:

The first, runs from south-east to north-west, and passes through the plaza. This would boost pedestrian traffic through the plaza.

The second, the strong east-western axis that passes just outside the plaza, occupying the same area of vehicular traffic, creating a conflict between pedestrian and vehicular traffic and thus raising safety concerns.

This alternative would thus enhance pedestrian traffic through the plaza, but would still not benefit from the east-western axis, to the contrary, it would create a serious traffic problem, as the realm of pedestrians coincide with the realm of vehicles as shown in Fig. 10

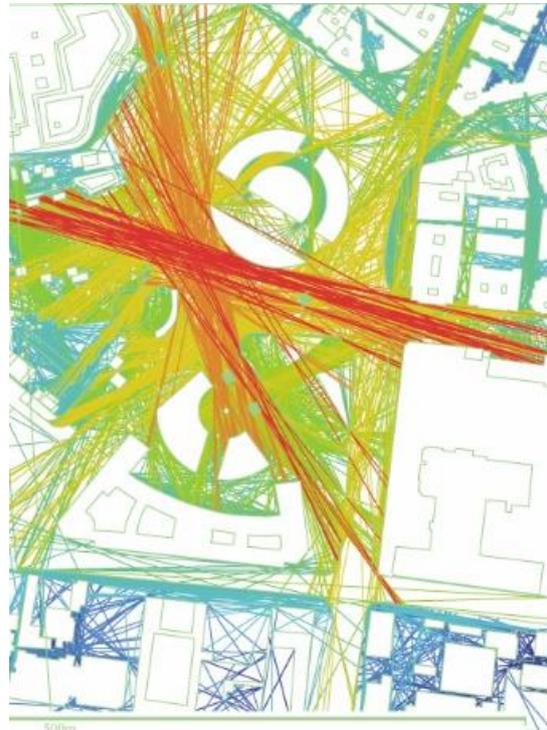


Fig. 10 Integration Map for The First Alternative of El-Tahrir Complex Plaza, Source: Author

6.3.2. The Second Alternative:

At this alternative, several pedestrian paths (main and secondary) were proposed in El-Tahrir Complex Plaza, and linked to the surrounding urban space. The plaza was divided into two main parts, the first for the visitors of the complex and the presence of a circular dot for their gathering in front of the building, and the other close to the borders of the street and the American University in Cairo, which provides the greatest opportunity for the establishment of activities for pedestrians, to enhance the use of the plaza, whether for user`s movement, and pedestrians, or the establishment of activities within it. as shown in Fig. 11

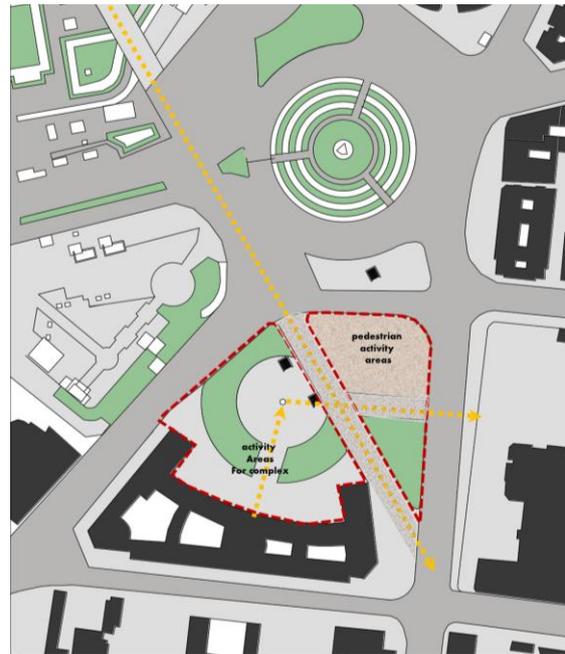


Fig. 11 The Third Alternative Layout, Source: Author

By testing this alternative using Space Syntax, it was found that:

The integration map shows that the integration core now passes clearly through the middle of the plaza, instead of passing around the plaza only, as is the case in the existing plaza, without a conflict between pedestrian and car traffic. The choice maps show that the highest choice axis coincide with the integration axis, emphasizing it`s importance. This proposal would considerably enhance the number of people passing through the plaza and accordingly, would increase the activities, as shown in Fig. 12.

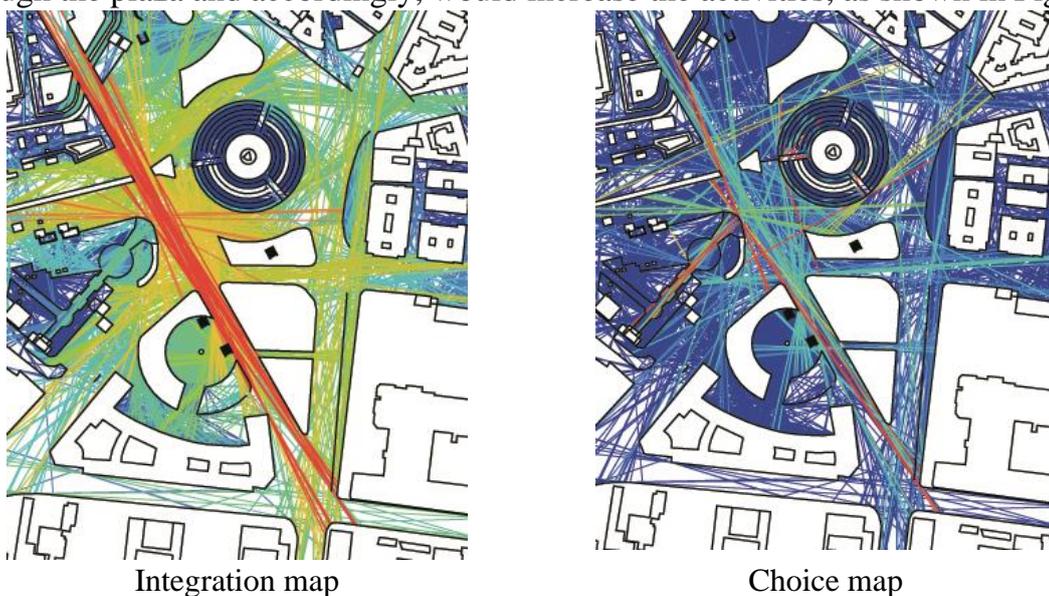


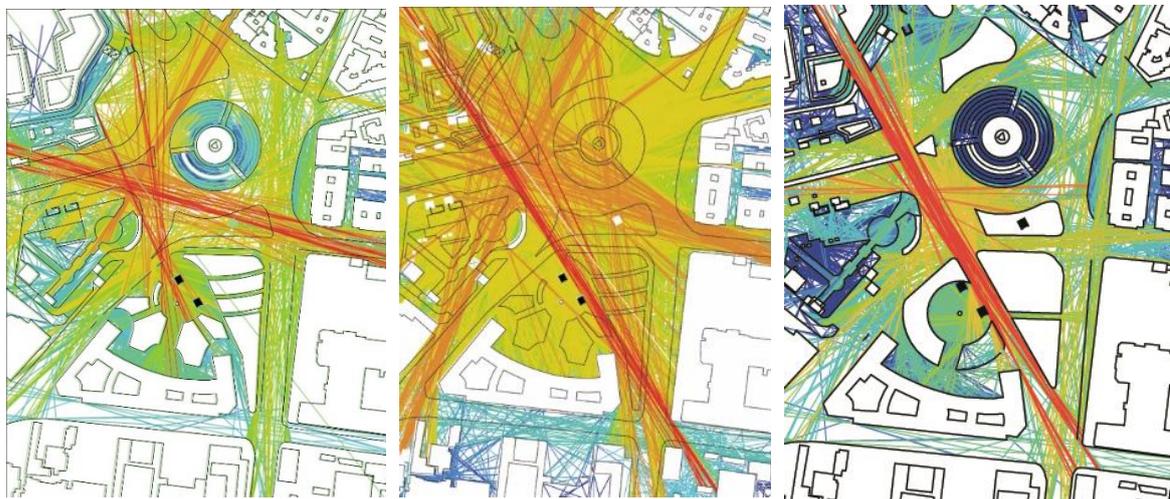
Fig. 12 Syntactical Maps for The Third Alternative of El-Tahrir Complex Plaza, processed by DepthmapX 0.8, Source: Author

The analysis indicate that the third alternative could be the best proposed alternative to enhance the functionality of El-Tahrir Complex Plaza. the previous alternatives and analyzing the syntactic maps, and it shown in the following:

- According to the integration maps, the pedestrian path is diverted inside El-Tahrir Complex Plaza rather than passing around the plaza only, as is the existing plaza planning, which increases the opportunity to establish activities inside the plaza with no conflict between pedestrian and car movement.
- The high value core passes inside the El-Tahrir Complex Plaza were found through choice maps, as a consequently, more activities, such as movement and stability, are achievable.

Based on previous studies and based on the stages followed to enhance performance of El-Tahrir Complex Plaza, the study predicted the best alternative after studying the previous alternatives, which is the third alternative. Thus, the following conclusions are reached for El-Tahrir Complex Plaza enhancement:

- 1- The passage of the path is more integrated within the plaza area of the El-Tahrir Complex Plaza.
- 2- Connect the El-Tahrir Complex Plaza with the surrounding plazas and buildings.
- 3- A clear way starts from the Egyptian Museum, Mohamed Mahmoud Street, and the American University in Cairo to El-Tahrir Complex Plaza.
- 4- There is no conflict between the path of cars and the path of pedestrians in the plaza and its surroundings.



Existing Plaza`s layout
(with fences)

Plaza`s layout without
fences

Plaza`s design enhancement

Fig. 13 Enhancement Process of El-Tahrir Complex Plaza, processed by DepthmapX 0.8,
Source: Author

7. Conclusion:

The above findings show that pedestrian movement is highly correlated with accessibility, and that static activities is also correlated with axial integration, and visual integration, and that availability of seats in the right location would increase space usage. The findings thus confirmed the consistently reported findings that a significant strong correlation exist between integration and pedestrian movement, and to a lesser extent, between integration and visual integration and actual space use. An important finding is that presence of adequate seats is necessary for activities to take place, and that integration alone is not adequate to encourage activities, if the space is not properly designed or adequately equipped with furniture that support such activities.

The process followed in the study utilized Space Syntax as both an analytic and diagnostic tool and as a design tool. Current status situation was analyzed and diagnosed, problems were identified, actions were proposed, alternatives were tested, in light of the proposed actions, and best alternative that is likely to enhance plaza's utilization was identified.

This study demonstrated what others found, that Space Syntax is a quite useful tool for investigating the performance and use of urban spaces. It confirmed findings by others that accessibility affect open space use pattern. To conclude, the study found that Space Syntax is a quite useful evidence-based diagnostic and design tool that can significantly enhance urban space design process and outcomes, leading to better designed spaces that meet its users' needs.

Future post occupancy evaluation studies of completed projects where Space Syntax were used either as a diagnostic or as a design tool are needed to verify its findings and determine its accuracy in predicting users' behavior. More studies are also needed that incorporate multiple factors to produce more accurate predictive models and algorithm, which would enhance Space Syntax's predictive strength. This kind of studies is necessary to advance Space Syntax approach and to convince practitioners of its merits as a reliable design tool in urban consultancy.

8. References:

¹ A. Husnein, "The Evolving Role of Modern Urbanistic Heritage in Shaping Sustainable Public Realm: The Case of Abu Dhabi," *International Review for Spatial Planning and Sustainable Development* 5 (2017): 5–24.

² H. Farouk and M. Youssef, "Movement Patterns Analysis in The Spatial Configuration Based on The Notion of Space Syntax," *Journal of Engineering And Applied Science Faculty of Engineering, Cairo University* 67, No. 2 (2020).

³ K. Lynch, *A Theory of Good City Form* (Mit Press, 1981).

⁴ C. Marcus and C. Francis, *People Places: Design Guidelines for Urban Open Space* (John Wiley & Sons, 1997).

-
- ⁵ S. Bendjedidi, Y. Bada, and R. Meziani, "Urban Plaza Design Process Using Space Syntax Analysis: El-Houria Plaza, Biskra, Algeria," *International Review for Spatial Planning and Sustainable Development* 7 (2019).
- ⁶ William H. Whyte, *City: Rediscovering the Center* (University of Pennsylvania Press, 2009).
- ⁷ William H. Whyte, *The Social Life of Small Urban Spaces* (Conservation Foundation Washington, DC, 1980).
- ⁸ M. de Arruda Campos and T. Golka, "Public Spaces Revisited: A Study of the Relationship between Patterns of Stationary Activity and Visual Fields," in *Proceedings of the 5th International Space Syntax Symposium*, 2005.
- ⁹ Y. Bada, "The Impact of Visibility on Visual Perception and Space Use: The Case of Urban Plazas in Biskra" (Université Mohamed Khider-Biskra, 2012).
- ¹⁰ A. van Nes and C. Yamu, *Introduction to Space Syntax in Urban Studies* (Gewerbstrasse 11, 6330 Cham, Switzerland: Springer Nature, 2021), p. 224.
- ¹¹ A. van Nes and C. Yamu, *Introduction to Space Syntax in Urban Studies* (Gewerbstrasse 11, 6330 Cham, Switzerland: Springer Nature, 2021), p. 224.
- ¹² H. Elsamaty et al., "Space Syntax as an Operative Tool in 'Pedestrianization' Process," *Port-Said Engineering Research Journal* 20 (2016): 63–68.
- ¹³ A. van Nes and C. Yamu, *Introduction to Space Syntax in Urban Studies* (Gewerbstrasse 11, 6330 Cham, Switzerland: Springer Nature, 2021).
- ¹⁴ A. Mohamed, "Spatial Conditions for Sustainable Communities: The Case of Informal Settlements in GCR" (Master Thesis, Department of Urban Planning, Ain Shams Univers, 2010).
- ¹⁵ Xia, Xiaolin, "A Comparison Study on a Set of Space Syntax based Methods: Applying metric, topological and angular analysis to natural streets, axial lines and axial segments." (2013).
- ¹⁶ "Space Syntax Laboratory | The Bartlett School of Architecture - UCL – University College London," accessed June 17, 2022, <https://www.ucl.ac.uk/bartlett/architecture/research-projects/space-syntax-laboratory>.
- ¹⁷ B. Jiang, C. Claramunt, and B. Klarqvist, "Integration of Space Syntax into GIS for Modelling Urban Spaces." (*International Journal of Applied Earth Observation and Geoinformation* 2, no. 3–4, 2000).
- ¹⁸ Cutini, Valerio, V. Di Pinto, A. M. Rinaldi, and F. Rossini, "Informal Settlements Spatial Analysis Using Space Syntax and Geographic Information Systems." (In *International Conference on Computational Science and Its Applications*, pp. 343-356. Springer, Cham, 2019).
- ¹⁹ Al-Sayed, K., A. Turner, B. Hillier, S. Iida, and A. Penn, "Space syntax methodology." (Bartlett School of Architecture, UCL: London, UK, 2014).