

Using Space Syntax To Analyze The Location of The Central Library A Comparative Study Between Designed And Cumulative Universities

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Keywords	Abstract
space syntax, designed universities, cumulative universities, Central Library location	<i>The research dealt with the study of the location of the central library within the urban structure of universities, due to the importance of the central library, and the fact that it stands on top of other libraries, as well as that it represents the backbone of the university institution. The current research aims to verify the suitability of the library's location for its function, and whether there is a difference between the two types, one designed and the other accumulative in design. In order to achieve the goal of the research, ten samples of universities were selected as a case study for this purpose, and their plans were analyzed and the properties of the space installation were measured for each of them using space syntax analysis. we conclude that the designed universities showed better results for the location of the library and its relationship with the complete complex, as it showed that choosing the location of the library was appropriate for its function. We can also conclude that there are no significant differences between the universities in terms of the location of the library, and that the additions made to the universities that have grown cumulatively did not significantly affect their initial design.</i>
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1. INTRODUCTION

Given the importance of the central library, and being on top of other libraries, as well as being the backbone of the university institution, and the most important supporting buildings for colleges and educational institutions, and by reviewing the history of universities to select the case studies, it became clear that there are two types designed and accumulative growth, So the research aims to verify the suitability of the library's location for its function, and whether there is a difference between the two types,

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to achieve the goal of the research, ten samples were selected from universities of different sizes, designs, and locations around the world, as case studies.

This research provides a look into the spatial properties of the library's location were plans analyzed and the characteristics of the spatial structure measured for each of them using the space syntax analysis, and then the results of the analysis were compared to reach the final conclusions and to answer the research question.

2. UNIVERSITY DEFINITION

The university is a source of knowledge of the world, and manpower with high skills for professions in the whole world, and it differ in their functions, goals, mission, programs, qualifications required for faculty members, criteria for accepting students, duration of study, and the type of certificate they grant (Assié-Lumumba, 2005; Alemu, 2018).

2.1 Types of Universities

The university can be classified into two categories: (Abbas, 2011)

1. The integrated type: the location of the university is intertwined with the fabric of the city, so it is limited. In this category, the university mainly provides academic facilities, while it depends partially or entirely on the housing and service facilities provided by the city.
2. The campus type: In this class, all academic and residential university facilities, as well as service facilities, are combined together within one integrated site, and these universities are often outside cities, and are not in centers due to the difficulty of providing sufficient space for all these facilities. The research dealt with the first type of universities for study.

2.2 University Environments

The university environment is the place through which science and academic knowledge are acquired, training and rehabilitation is received, skills are developed, and all activities and events are practiced, And peaceful coexistence among members of society. There are three systems of the university environment that work together and cannot be separated from each other (Al-Jumaili, 2012)

- 1) The first pattern: This is the spread of the specialized and public educational spaces of the university on the site with a central gathering of the public auxiliary spaces.
- 2) The second pattern: This is a dispersed community of colleges independent of each other and separate teaching departments. Each department is unique in its educational and service spaces, administrative structures, and other recreational spaces.
- 3) The third pattern: in which the educational spaces and public assistance are linked together by an urban organization.

From what was mentioned above, it can be said that there are universities that are designed, that is, the basic design idea of their campus follows one of these three patterns. It may move from one style to another depending on the places where these changes occur and the way the buildings are connected and their relationship with each other.

2.3 Campus Planning Patterns

The urban patterns of the campus structure can be determined depending on the quality of the internal structure of the university and the characteristics of its constituent elements, spaces and their relationship with the surroundings. The internal structure of the campus complex can be divided into seven types (Grid, Linear, Central, Central-Multi, Radial, Organic, irregular geometry) (Calvo-Sotelo, 2014). From this classification, it is clear that the diversity and changes in the patterns of the urban structure of the university campus, which may be in accordance with the requirements of place and time, and the variables of social and economic life, etc., The current research does not focus on a specific planning pattern for the university campus, given that the planning pattern does not affect the relationship of the buildings with each other, "the functional connection of all parts of the campus by virtue of their presence within one university campus" (Altalib & Aljaberi, 2017), as important as the fact that these planning patterns are designed or cumulative in growth.

3. DEFINITION OF THE UNIVERSITY CENTRAL LIBRARY

The university central library is not a place where sources of information such as books, periodicals, etc. are collected, but it is more important and comprehensive than this concept. The university central library embodies a message that is to serve university education and scientific research, by supporting curricula and courses, developing the ability to obtain information, and developing and advancing scientific research (Al-Shawani, 2020)

3.1 Library Location at The University

The library has a great priority in the university, as it can be said that it is the most used building among the university buildings. The researcher (Al-Dabbagh, 1993) points out that choosing the right place for the library is of great importance, especially when constructing a building for it, because this place has a major role in its activity and its success in attracting readers and the important characteristics of an effective library site are (Accessibility which means ease of access, Centralization which reinforces the importance of the library as a symbol of education and makes it a dominant building on the site, Legibility which means distinctive location of the library, as well as its clear entrance, and its location within other auxiliary spaces such as the student club, the cafeteria, and the great hall, which are often organized around an open space in the center of the university, confirm the generality of the use of these buildings). It is clear from the foregoing that the library, in order to function efficiently and effectively, must achieve the characteristics mentioned above, and to achieve these characteristics, the site must be designed.

4. SELECTED UNIVERSITY AS CASE STUDIE

4.1 History of Universities

By reviewing the historical file of a group of universities, we found that there are universities whose campuses were designed from the beginning with the determination of their future expansion, while there is another group that was cumulative in its future

growth and expansion. Five universities were chosen for both types (designed and Cumulative) as study cases.

5. METHODOLOGY

Space syntax refers to a group of space configuration analysis techniques (Spatial Configuration), and the set of theories that link space with society, as researchers were able to link the spatial Configuration to where people are, how they move, how they decorate and adapt space, and how they talk about it, and thus allow the interpretation of space phenomena from a social point of view (Hillier, 2014). The Space Syntax method works with three basic elements: the axial line, the convex space, and the isovist field. The main idea of these basic space elements is that humans move in lines, interact in convex spaces, and see changing scenes when moving around the built environment this tools can understand space shapes by converting space layout into a series of defined spaces, lines of sight, and visual locations.

The analysis of Configuration properties includes the following analyzes: convex space analysis, axial analysis, and visual analysis (van, 2011). Except squares, most urban public space (streets, roads, paths, avenues, pavements, or boulevards) is linear. Therefore, we can represent each spatial element of the street network as an axial sightline which indicates the movement paths. The axial map represents the maximum optical kinetic extension of any point in one dimension, as it consists of the least number of straight lines that cover all the system (van Nes & Yamu, 2021).

Connectivity is a local measurement that aims to determine the relationship between each street with the other streets that directly adjacent to it. The high value means it contains many connections with the streets that are directly connected to it, while the low value means it contains the fewest connections (Hillier& Hanson, 1984) Integration is a measurement that aims to 'predict' the pedestrian movement in the street and determined whether it is dense or segregated (Ozbek et al, 2014). As there is a relationship between the presence of people and integration, a high value of integration means the presence of a large number of people in the space, while a low value of it means the absence of people and the space is more isolated and private (Dettlaff, 2014). Control is a local measure that depends on the relations between space and the spaces directly neighboring to it. Control value means the degree to which a space access to these spaces. A high value means strong control and density of pedestrians, while a low value means little control and isolation. (Lamprecht, 2020).

6. RESULTS

The differences between the designed and accumulative universities were examined by using Depthmap. The results of the analysis showed that the library location in the designed universities is as follows: The value of integration (Global measurement) is very high for four universities and relatively high for one university. As for the value of connectivity (Local measurement), it was very high for three universities and medium for two. The control value (Local measurement) was very low for three universities and medium for two (Fig. 1, table 1)

The results of the analysis showed that the library location in the cumulative universities is as follows: The value of integration (Global measurement) is very high for four universities and relatively high for one university. As for the value of connectivity (Local measurement), it was high for one university, medium for two universities, and low for the other two universities. The control (Local measurement) was low for three universities, medium for one university, and high for the other university (Figure 2, table 2).

Table 1. (Integration, Connectivity, Control) Value for designed universities

designed universities	variables	library location	maximum	Minimum	mean	
1	Qatar University	Integration	2.12	2.12	0.57	1.345
		Connectivity	21	21	1	11
		Control	2	9.7	0.39	5.045
2	Princess Noura University	Integration	0.926	1.01	0.432	0.721
		Connectivity	13	15	1	8
		Control	4.2	5.15	0.25	2.7
3	University of Baghdad	Integration	0.84	0.84	0.366	0.603
		Connectivity	4	5	1	3
		Control	1.29	3.366	0.16	1.763
4	University of Kufa	Integration	1.01	1.62	0.31	0.965
		Connectivity	12	19	1	10
		Control	3.78	7.29	0.25	3.77
5	University of Iowa	Integration	3.36	3.56	1.1	2.33
		Connectivity	20	34	1	17.5
		Control	4.6	11.6	0.1	5.85

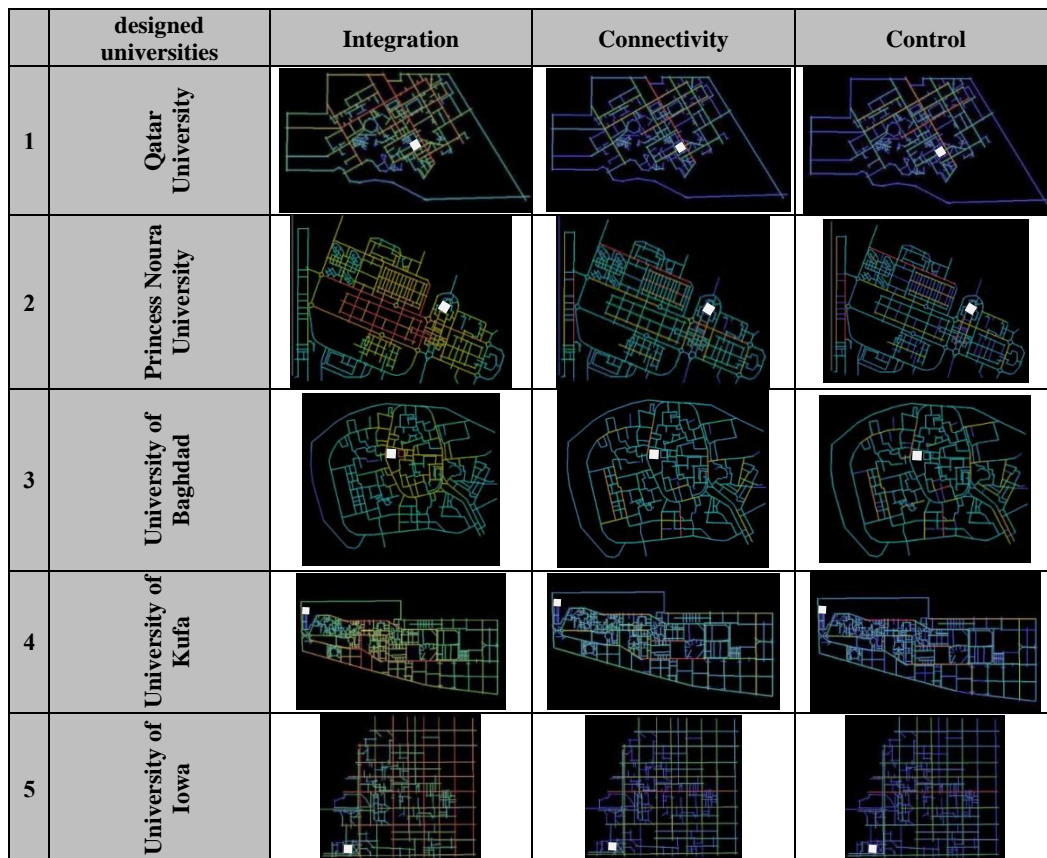


Figure 1. Global integration & local (connectivity, control) axial analysis by using depthmap

Table 2. (Integration, Connectivity, Control) Value for cumulative universities

	cumulative universities	variables	library location	maximum	Minimum	mean
1	University of Mosul	Integration	1.125	1.272	0.357	0.8145
		Connectivity	13	15	1	8
		Control	3.26	4.97	0.11	2.54
2	Weber state university	Integration	0.566	0.869	0.36	0.6145
		Connectivity	6	15	1	8
		Control	1.6	6.16	0.14	3.15
3	University At Albany Uptown Campus	Integration	1.154	1.191	0.45	0.8205
		Connectivity	16	27	1	14
		Control	4.8	10.6	1	5.8
4	SJSU Timeline University	Integration	2.37	2.5	0.9	1.7
		Connectivity	11	21	1	11
		Control	4.8	8.44	0.09	4.265
5	University of Miami	Integration	1.44	1.9	0.57	1.235
		Connectivity	6	18	1	9.5
		Control	1.11	8.46	0.30	4.38

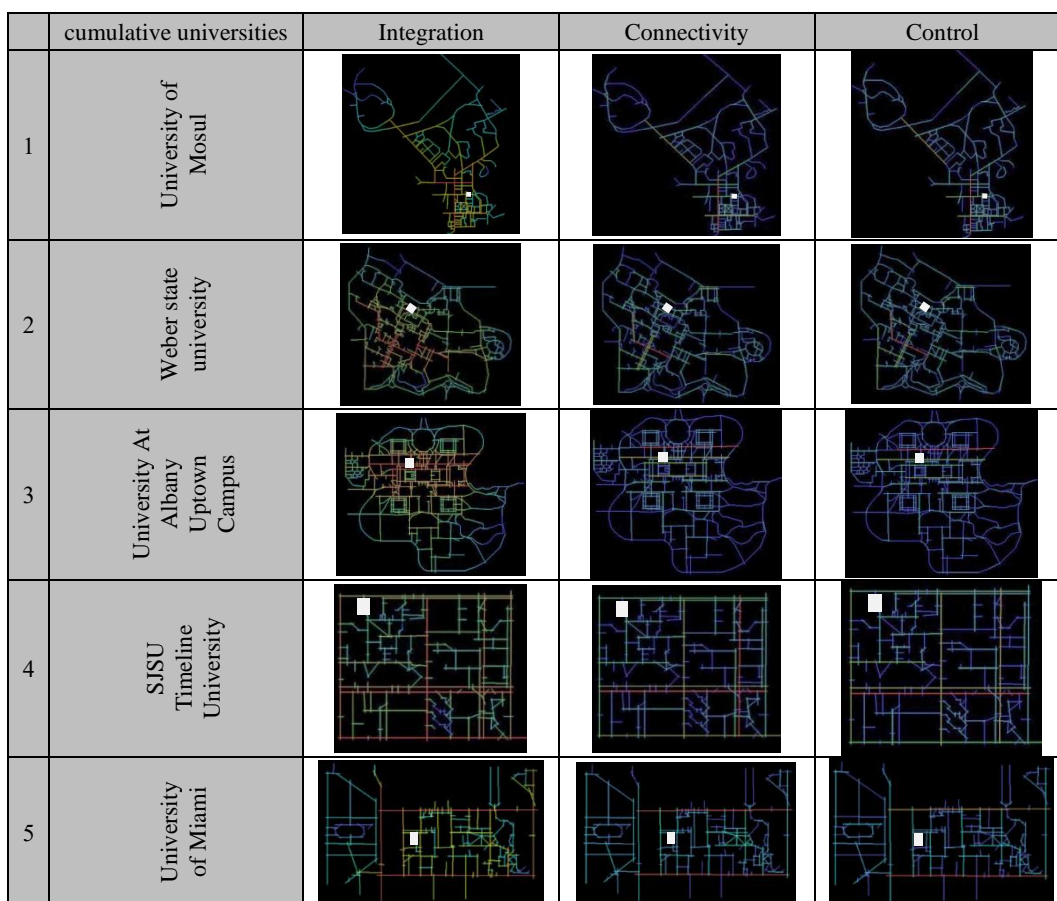


Figure 2. Global integration & local (connectivity, control) axial analysis by using depthmap

7. CONCLUSIONS

The results of the analysis showed that the library site integration is high for all universities, and from this we conclude that the library site represents the destination for the university where there are a large number of people. But the value of the integration of the library site in the designed universities is higher than that of the cumulative universities. With regard to connectivity, the results showed that the designed universities have relatively high connectivity, which means that the library site is contains many connections with the streets that are directly connected to it.

As for control, the results showed a low value for most universities and for the two types, which means that accessibility and pedestrian density from neighboring sites are low.

Accordingly, we conclude that the designed universities showed better results for the location of the library and its relationship with the complete complex, as it showed that choosing the location of the library was appropriate for its function. We can also conclude that there are no significant differences between the universities in terms of the location of the library, and that the additions made to the universities that have grown cumulatively did not significantly affect their initial design.

Conflict of Interest

Authors declare that there is no conflict of interest.

Contribution of Authors

Shaymaa Kh. Abdulqader: Conceived and designed the analysis; Collected the data; Wrote the paper. Eman Kh. Al-Moula: Data analysis & Wrote the paper. Noor Y. Al-Tamer: Data analysis.

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