

A Spatial Evaluation for Different Districts using Space Syntax

Amro Abdelalim*

Assistant Lecturer at Architectural Engineering Department at Fayoum University, Egypt

***Corresponding Author:** Amro Abdelalim, Assistant Lecturer at Architectural Engineering Department at Fayoum University, Egypt.

Received: March 03, 2025; **Published:** March 06, 2025

Abstract

Streets are considered to be a major urban element in any city in the world. Studying them and how they are interconnected together helps understand how vibrancy in urban settlements is created or fixed. This paper is an extension to a previously published paper where it compares the effect of different urban elements resulted from streets and streets network in different districts. It investigates the correlation between streets attributes of length, width, integration and choice with pedestrians flow and vehicular movement.

Keywords: Urban Form; Vibrancy; Connectivity; Space Syntax

Introduction

Cities are simply composed of buildings and streets. Streets are responsible for the circulation and movement for pedestrians and vehicles. They interconnect with each other in a way that they help increase the functionality and efficiency to some level. Being able to use urban networks simulation makes it much better and more accurate to take better decisions and evaluate the impact, either being positive or negative.

Urban Form

Urban form is one of the important elements to show the connection and level of interaction in any urban settlement. It is the way and level of intersection of streets, considered and perceived as the axes of movement for both of pedestrians and vehicles. As a term, urban form can be defined as the network of buildings and axes of movement, all gathered together in one map. Urban form is conceived in terms of three components, within the Conzenian morphological tradition (Conzen MRG., 1960): (i) the system of roads and open spaces; (ii) the system of plots and buildings organized on plots; (iii) land-use patterns. Conzen's components mirror those described by Jane Jacobs (Jacobs J, 2016) as characteristics promoting vitality in the urban environment: combination of land uses, road network layout, typological variety of buildings, and density.

Vitality & Vibrancy

Vitality can be defined as the degree to which a space is alive or lively (Montgomery J, 1998). It is also the capacity of urban places to meet vital functions and biological requirements of individuals or as the synergy created by the diversity of unique commercial and entertainment opportunities and a heterogeneous pedestrian population, or as the result of the intensity and plurality of utilitarian, recreational and social activities staged by the public space and facilitated by the diversity of economic activities and by the complexity of urban form (Lynch K., 1984; Maas PR., 1984; Montgomery J, 1998; Tang L. et al., 2018; Ye Y. et al., 2018; Zumelzu A. & Barrientos-Trinanes M., 2019). Vibrancy is one of the defining elements of an urban settlement to show its functionality and livability. A vibrant urban settlement is the one that is having its residents moving and interacting in high rates where a movable settlement results in a

vibrant one, and a non-movable one shall result in a ghost area. It should be mentioned that vibrancy is highly related with diversity of land uses, especially the presence of commercial and administrative uses. Also the movement of cars in a settlement differs from that of pedestrians where some factors raise the movement of cars and other ones affect pedestrians movement.

Methodology

In urban analysis 'axial lines' were mostly used. This is the longest uninterrupted visibility line that can be drawn in a plan of a city or settlement. Resulted collection of such drawn lines covering the entire study area is called an 'axial map' (Hillier and Hanson, 1984). This method calls for identifying the fewest and longest number of possible lines through the open space system (Haq, Saif, 2021). Drawn in this way, it gives some resulted measures of connections of the lines and the points of intersection. As for applications, Depth map is the software used to analyze spaces in cities and buildings according to space syntax principles. To conduct this study, axial analysis was done to generate a map of axial lines representing neighborhood streets.

Application of Space Syntax:

Application of Depthmap Software was used for analysis and generating the measures of integration and choice-to-depth. The following steps were done to obtain the values for representing Accessibility:

- After the AutoCAD Motamayez district map was drawn in lines and after extending the lines to ensure the true intersection between lines to be read by DepthMap, it was then exported in (.dxf file) to be read by the software.
- After importing file in DepthMap, it was (converted to an Axial Map).
- Scale was checked (from Line Depth) to ensure that the lines correspond to reality and read correctly.
- Connections (which are less than one) were checked so as to avoid any mistake or misleading lines upon conversion from AutoCAD.
- Lines lengths were not permitted to be (< 0.1) to ensure that there are no mistakes in drawing.
- Run Graph Analysis was performed with the following included options (Choice/ Local Measure/ According to Weighted Measures).
- A new column was added representing a value relating choice to total depth as follows: ($Choice\ Normalized = \frac{\log(value("Choice")+1)}{\log(value("Total\ Depth")+3)}$). (1)
- Integration and Choice-to-depth measures were generated and read from the file.

Case Studies: 6th of October City & Sheikh Zayed City

6th of October city is located next to Cairo, the capital of Egypt. It is one of the newly-developed urban settlements that can house millions of people.



Figure 1: A photo from Google Earth showing Location of the Motamayez District in 6th of October city from Cairo, Egypt capital. Source: Google Earth, 2023.

It is linked with Cairo, the capital through a primary corridor named 26th of July which already witnesses passage of a huge number of vehicles on a daily basis making it an important hub for the development of Egypt and expected to house more and more citizens.

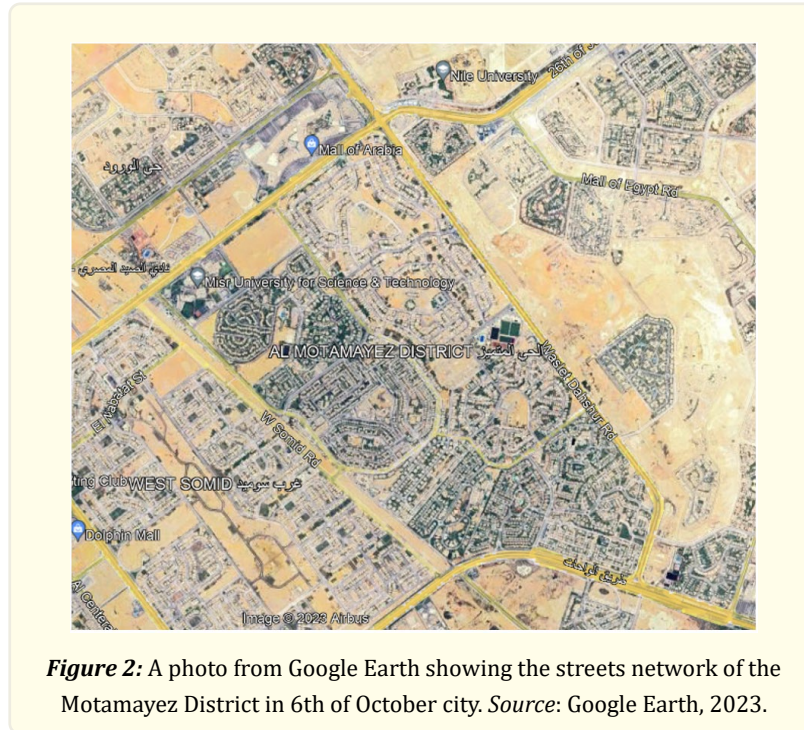


Figure 2: A photo from Google Earth showing the streets network of the Motamayez District in 6th of October city. Source: Google Earth, 2023.

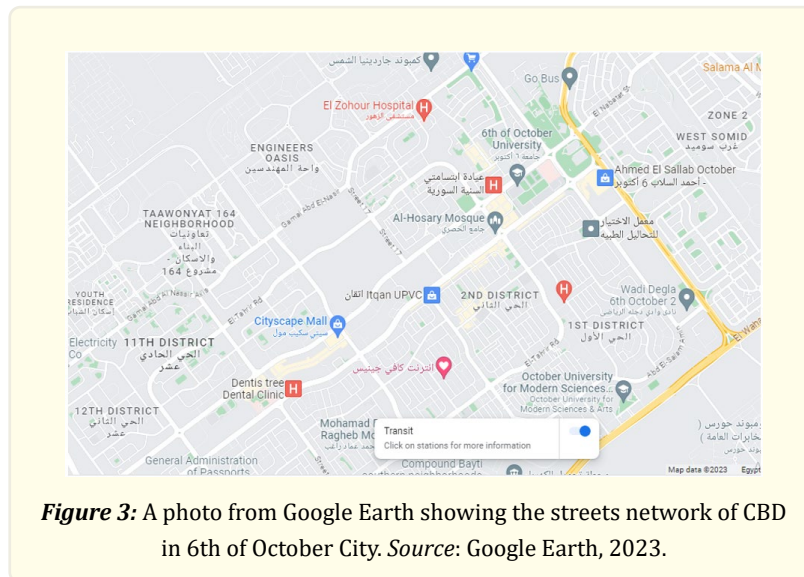


Figure 3: A photo from Google Earth showing the streets network of CBD in 6th of October City. Source: Google Earth, 2023.

The district consists of a number of streets connecting the different residential areas. It is linked with the main corridor of “26th of July” from the north. It is considered to be a residential one housing different types of buildings and uses served through the shown network of streets. A sample of 20 streets located in the figure was chosen to make the analysis.



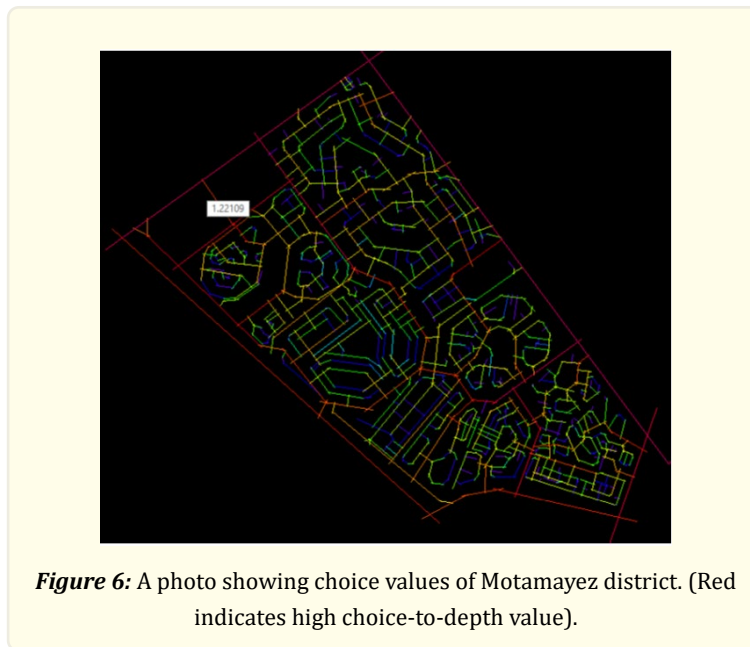
Figure 4: A photo showing axial map of streets network of Motamayez District. *Source:* Author.



Figure 5: A photo showing integration values of Motamayez district. (Red lines indicate routes with high integration value).

Integration is a normalized measure of distance from any a space of origin to all others in a system. It calculates how close the origin space is to all other spaces (Hillier B., Hanson J., 1984).

Source: By Researcher through Depthmap software.



Choice measures how likely an axial line or a street segment is to be passed through on all shortest routes from all spaces to all other spaces in the entire system (Hillier et al., 1987).

Source: By Researcher through Depthmap software.

Results

Results obtained in research include values of integration and choice to depth of different streets in each district obtained from depthmap software, in addition to streets length and width measured from google earth for each district. Each district has its own streets network attributes according to its network and collected data of flow of pedestrians and vehicular movement. Collected values and numbers in each district are compared with each other to investigate the level of correlation indicating level of livability and vibrancy.

Conclusion

Comparing the numbers of different attributes of streets together have shown significant results. Each of the attributes of street length, width, integration, choice-to-depth for each street has its unique impact on the flow of vehicles and pedestrians. In Motamayez district, street length and choice to depth attributes have shown to have bigger impact on the flow of vehicles where the longer the street and the higher its value of choice-to-depth, the more probable it will have flow of vehicles. On the contrary, street width and integration have shown to have smaller impact upon the flow of vehicles. Pedestrians movement has shown to have weaker correlation with attributes of street length, width, integration and choice to depth in Motamayez district.

References

1. Conzen MRG. "Alnwick, Northumberland: a study in town-plan analysis". Transactions and papers (Institute of British Geographers) III-122 (1960).
2. Hillier B and Hanson J. "The Social Logic of Space". Cambridge University Press, Cambridge (1984).
3. Hillier B, et al. "Creating life: Or, does architecture determine anything?". Architecture et Comportement/ Architecture and Behavior: 3(3) (1987) pp. 233-250.

4. Jacobs J. "The death and life of great American cities". Vintage, New York (2016).
5. Lynch K. "Good city form". MIT Press, Cambridge, Massachusetts (1984).
6. Maas PR. "Towards a theory of urban vitality". Doctoral dissertation, University of British Columbia (1984).
7. Montgomery J. "Making a city: urbanity, vitality and urban design". J Urban Des 3 (1998): 93-116.
8. Tang L., et al. "Exploring the influence of urban form on urban vibrancy in shenzhen based on mobile phone data". Sustainability (2018).
9. Ye Y, Li D and Liu X. "How block density and typology affect urban vitality: an exploratory analysis in Shenzhen, China". Urban Geogr 39 (2018): 631-652.
10. Zumelzu A and Barrientos-Trinanes M. "Analysis of the effects of urban form on neighborhood vitality: five cases in Valdivia, Southern Chile". J Housing Built Environ 34 (2019): 897-925.

Volume 8 Issue 3 March 2025

© All rights are reserved by Amro Abdelalim.