The Impact of The Characteristics of Spatial Organization of Historic Castles on The Urban Development Strategies for The Surrounding Areas "Salah Al-Din Citadel in Cairo as a case study"

Omar Abdulwahhab Khalaf [1, 2, 3*], Alhan Faris Ibrahim[1], Nor Haslina Ja`Afar [2, 3]
[1]Department of Interior Design, Cihan University-Erbil, Kurdistan Region, Iraq
[2]Centre of Innovative Architecture & Built Environment (SErAMBI),
[3]Secretariat of National Identity Architecture, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia

Abstract--This paper deals with the historical overview of the castles and forts and what are the rules and foundations on which they arose. Castles constitute tourist attractions at the global and local levels as well as studying the variables and elements of spatial organization, in addition to the concepts of urban development strategies for historical regions. Salah al-Din Citadel was elected in Cairo because of the historical and urban depth it carries today. By studying how it originated and what changes occurred on it after the explorations and excavations that are taking place (design and development strategies) and then the practical study and analysis of the results of the practical study (General conclusions). The aim of the study is to analyze the urban fabric of Salah al-Din Citadel and define indicators for the characteristics of spatial organization using the Geographic Information Systems Program (GIS) and (Space Syntax) analysis, as they have an impact on the development of city centers and their importance in shaping the urban body of the city in an attempt to reach the strategies for urban development and possible urbanization of historic city centers (especially the cities of the castles). From the review of studies that dealt with the study of the organizational characteristics of urban spaces, the research problem crystallized (The lack of a clear perception of studying the characteristics of the spatial organization of castles and their impact on the development of urban development strategies) and the research hypothesis was formulated with (The study of the characteristics of the spatial organization of castles affects the integration of the castle with its urban surroundings and its historical characteristics). The research was based on the development of the elements of a theoretical framework on the characteristics of spatial organization and then applied in practice to the castle of Salah al-Din as a model.

Keywords: spatial organization, space syntax, historical citadels, GIS.

DOI: http://doi.org/10.24086/aces2020/paper.264

1- Introduction:

The word “fort” defines the immune position and also means the castle or citadel. The fort is the fortified fortress (Wikipedia Encyclopedia). While the castle is known in the language as the great bulwark on the highlands or on the mountain, as well as the castle is known as those large stones carved out of the mountain, and the castle was also known as the stronghold or the fortified place that is used to resort to it against dangers. The castle is a miniature city within the city and is always built in elevated places on the ground because its main function is protection and defense, as the fortress contains all the elements of the city from a place of governance that is represented by the ruler's palace, as well as contains markets, a large courtyard, baths, sectors of housing and places of worship, whether they are Mosques or convents and may contain them together as in the citadel of Aleppo and the Citadel of Hamra in Granada and other castles. (Al-Hankawy & Al-Kubaisi, 2010)

The peoples of the ancient world and the mediator knew about the forts and castles. They called for the establishment of the conditions of life in which fighting abounds and invasions and raids spread. In choosing the location of forts and castles, several conditions were considered, the most important of which is the height to control the surrounding lands. Castles and fortresses spread in the countries of Greece, the Romans, Persians, India, and Egypt in the ancient world, and then they spread from a distance in the regions and countries of the Islamic world in the Middle Ages, and Muslims built them often in the high peaks overlooking the valleys and rivers, and the remains of the many Islamic fortresses still remain. Fortresses were known in the Arab world in the days of the Ayyubids in Syria and Egypt. The Aleppo Citadel was built in 568 AH / 1172 CE, and the Citadel of the Mountain was built in 572 AH / 1176 CE. Castles are considered one of the most important defense establishments that appeared in the Middle Ages, especially in the Ayyubid era in which the military and defense architecture flourished, especially castles, towers and fences, and spread in many Arab and Islamic cities. The castles were built on high hills and mountains and overlooked the city to achieve the goal of defense and fortification against the aggressors, and rulers and sultans cared for it, and they raced in its construction and architecture until it became one of the prominent monuments of Islamic civilization in the ages of power, which still exist today in some Islamic cities to attest to the progress, glory, and prosperity

DOI: http://doi.org/10.24086/aces2020/paper.264

AD, until Muhammad Ali Pasha assumed the rule of Egypt where he restored her prosperity and greatness. Sultan Al-Nasir Salahuddin Yusef bin Ayoub was the first to think about building the castle on the hill of the Sowwah in the year 572 AH / 1176 AD, he ordered his minister, Bahaa Al-Din Qaraqosh Al-Asadi, to construct a citadel on Muqattam Hill. Consequently, according to the mediaeval historians, he probably damaged and demolished the mosques and graves and numerous small pyramids at Giza plateau in order to use their stones in the construction of the Citadel on the same place. The workers carved the rock and created an artificial trench separating Jabal Al-Muqattam from Sowwah increases its strength and strength. The walls of the citadel are considered one of the finest archaeological walls in the Islamic world, after many of their counterparts ceased in Samarkand, Bukhara, Aleppo, Damascus, and Sanaa. It was built by Bahaa Al-Din Qaraqosh, Minister of Salah al-Din, on the orders of his leader to protect the Egyptian capital from any crusade attacks. (Torky, 2020) & (Egypt State Information Service - Islamic Antiquities)

There are two interpretations for why Saladin selected Muqattam Hill to be the location of his citadel. Some historians state that during Medieval Ages in Syria, where Saladin born, the construction of of defensive architecture during previous times.(Wikipedia Encyclopedia, Cairo Citadel) & (Al-Hankawy & Al-Kubaisi, 2010)

2- Salah El-Din Citadel

2-1 Historical Background

A historical Background Saladin or Al-Jabal Citadel was founded in 1176 A.D. Salah al-Din al-Ayyubi Castle, known as Qalat al-Jabal, is one of the most important Islamic landmarks in Cairo. It is located in the “Castle” neighborhood. It was erected on one of the lords separated from Al-Muqattam Mountain on the outskirts of Cairo, and it is considered one of the most luxurious military castles constructed in the Middle Ages. Salah al-Din established this fortress on a hilltop from Mokattam Mountain, and was completed by his brother Al-Malik Al-Adil in 1208 AD, with the aim of securing Cairo against possible invasions. (Grandin, 2008)

The reason for building Salah al-Din fortress is that after he destroyed the Fatimid dynasty, the ministry of residence lived in Cairo, but he was afraid of the Fatimids in Egypt and thought he was working as a fortress. (Williams, 2008)

Many majestic castles and many historical events passed through its walls witnessed various historical events during the Ayyubid and Mamluk eras and the time of the French campaign against Egypt in 1798

DOI: http://doi.org/10.24086/aces2020/paper.264

Consequently, the region of Hijaz became one of the Mamluk Sultanate states in order to safeguard the Islamic pilgrimage and the Holy Places. The Ottoman period is distinguished in the Citadel by the mosque of Mohamed Ali Pasha and Gawhara Palace. The Citadel was the location of an important event during the reign of Mohamed Ali Pasha which is known as the "Mamluks Massacre". Mohamed Ali was appointed the ruler and a deputy of the Ottoman Sultan in 1805. He wanted to hold the power in his hand while Mamluk Beys were still dominating Egypt. In 1811, he decided to dispose of them. Mohamed Ali Pasha invited them to a great celebration at the Citadel. When the celebrations were over and everyone was leaving, Albanian soldiers shot them down on the narrow Bad Al-Azab road. Saladin Citadel remained a residence of Egyptian government until the reign of Khedive Ismail, when the power was transferred to Abdeen Palace. (Grandin, 2008) & (Wikipedia Encyclopedia, Cairo Citadel)

2-2 The description, contents, and construction of Salah El-Din Citadel in Mamluk era

Castle of the mountain over the Mokattam Mountain, and around it a wall building with towers. And it had two doors, its big door was facing Cairo, and the name was

fortifications and citadels on hills was common. While other scholars, like Al-Maqrizi, have narrated a story that Saladin ordered numerous pieces of meat to be hung in various locations, and according to this experiment, it was found out the air of 62 Muqattam Hill is regularly more fresh than the other areas, consequently he selected for his Citadel (Williams, 2008). Starting in the periods of Ayyubid Kings Al Kamel and Al-Adel, more modifications took place in the Citadel. King Al Kamel had particularly changed the internal design of some towers and fortresses. He also took the Citadel as a royal residence where he constructed a mosque, an audience hall, private palaces, and a library. The era of Mamluks is considered an illustrious era. Islamic architecture had flourished. Sultan Al-Zaher Babers had constructed the justice palace. Sultan Al-Nasir Mohamed Ibn Qalawun built his great mosque, "the Green Mosque", as well as other buildings. Unfortunately, in order to do that, he deconstructed more constructions of Ayyubid King Al Kamel. During the period of Mamluk Sultan Al-Zaher Babers, the Citadel played a great role as an administration center of the Islamic world. As a result of Mongol movements, al-Mustansir escaped to Egypt; on the other hand, Sultan Al-Zaher Babers has invested this situation by proclaiming him as Islamic world caliph.

DOI: http://doi.org/10.24086/aces2020/paper.264

The Ministry House, which was known as "Al-Saheb Hall", was located inside the campus of the castle, and it includes the Army Court and the Construction Hall (State Secretariat), and the House of Representatives lives and works in it by the Deputy Sultan. And it contained mosques, shops and markets. There was a prison locked by Sultan Al-Nasir Muhammad bin Qalawun in his campaign against corruption because of his heinousness and bad reputation. On the campus of the castle there was the Royal Stables and a large square in which the Sultan prayed for the Eid prayer, and at other times it was used as a playground in which the Sultan and the princes played. Al-Maqrizi says that the one who saw the castle and its harbor is aware of the sultans 'standing and spending capacity. (Wikipedia Encyclopedia, Cairo Citadel)

2-3 Important relics in Salah El-Din Citadel

The Citadel has two wings; the northern wing is the military wing which includes gates, towers, and fortifications while the southern wing is the civil wing where the royal palaces, library, 63 mosques and the administration offices are located. It was a fortress of the Islamic world throughout many periods: the Ayyubid era (12th century), the Mamluk era (14th century), and the Ottoman period (19th century). (The gradient door), and it had a chief of career position, a great name and the governor of the castle, the door to the amphitheater was also known as the "door of the dolphin" attributed to Prince "Hossam al-Din Lavin al-Idmari" (He changed the famous Sultan Lajin), which was called (al-Darfil), before the door was called Bab Sariya. And the second door was called "Cemetery door." Between the two doors there was a wide courtyard on the side of it houses, and in the front side a market for eating. There was a wide vestibule connecting to the houses and the castle collector, the vestibule contains entrances that reached a large square in the middle of the large Iwan, which contained the Sultan in the days of processions and in the days of receiving himself the grievances of ordinary people and their complaints (Dar Al-Adl) The square was adjacent to the door of the palace and the treasury of the palace that entered them was from a door called the door to victory. It had three palaces, a royal harem house, a garden, a bathroom, and a yard. In the rest of the castle were the houses of the Royal Mamluks and private princes close to the Sultan. The properties of the matter were living in the castle with their families and their property and their offices were inside the castle. The castle had buildings called Al Tebaq, where the new Mamluks lived, who were under education and training.

DOI: http://doi.org/10.24086/aces2020/paper.264

is the marble grave of Mohamed Ali Pasha. On the other side, there are two pulpits minbars. The largest one is made of wood and painted in golden and green colors that date back to the reign of Mohamed Ali Pasha, while the other minbar King Farouk had constructed in 1939 next to the prayer niche. (The Supreme Council of Antiquities, 1998) & (Williams, 2008)

2- Mosque of al-Nasir Mohamed Ibn Qalawun: This mosque was constructed between 1318 and 1335 A.D. It is distinguished by its green tiled dome and minaret, which has "fluted bulbous finials and glazed faience on the sides"; moreover, its arcades which were designed in the double-storied style using ablaq masonry. Columns were collected from Ptolemaic and Roman temples, and ruins of Christian churches and monasteries. (The Supreme Council of Antiquities, 1998) & (Williams, 2008)

3- Al- Jawhara Palace: One of the palaces in the castle of Salah al-Din al-Ayyubi next to the mosque of Muhammad Ali or the castle of Muhammad Ali has turned into a museum, the palace was built mainly to be the seat of the wife of Also, it remained a station of a military installation until 1983, when the site was first opened for visitors under the supervision of Egyptian Antiquities Organization (Williams, 2008).

1- Mohamed Ali Pasha Mosque: This mosque was built under the supervision of the Greek master designer, Yusuf Bushnaq, between 1833 and 1857. It was designed in the traditional Ottoman style of Istanbul. The open court Sahn is surrounded by domed arches. In its center, there is an ablutions fountain. At the far end of the court there is an ornate brass clock tower given to Mohamed Ali Pasha by French King Louis Philippe in exchange for an Egyptian obelisk. The clock was broken when it arrived in Cairo in 1845 and has never been repaired. The inner prayer hall is covered by a high central dome which is surrounded by four semi-domes and four little corner domes which are held up by four gigantic piers. These domes are covered externally by lead sheets. Beneath these, there are six large medallions with the name of Allah, the prophet Mohamed and the first four orthodox caliphs Abu Bakr, Omar, Othman, and Ali. To the right of the main entrance, there

DOI: http://doi.org/10.24086/aces2020/paper.264

founded in 1986 thanks to a joint-effort between the Supreme Council of Antiquities (SCA), the Ministry of Culture and the Ministries of Tourism and the Interior. An attachment to the building contains a real model of prison cells, which were constructed during the British occupation at the end of the 19th century. Within its six exhibition halls it displays the development of the Egyptian Police through history until the reign of modern Egyptian president Gamal Abd Al-Naser and even includes information on the crimes of the notorious Alexandrian sisters Raya and Sekina. (Supreme Council of Antiquities, 2010)

6- National Military Museum: It was originally founded upon the ruins of Haram Palace. It was established through a grant from the Democratic Republic of Korea between 1990 and 1993. It has numerous exhibition halls displaying the military history of the Egyptian army, throughout history from the ancient Egyptian era up until modern day. (Williams, 2008) This palace occupies a total area of about twenty-five thousand square meters with its buildings, gardens attached to it and its Muhammad Ali Pasha. (Wikipedia Encyclopedia, Cairo Citadel)

4- Yusuf Well: The Well has been called by several names. There are some people who called it "well of the snail - Bir Al-Halazun", while others called it Yusuf, or Joseph Well. Being that the Citadel was so near the old city al-Fustat, it was perfectly supported by the supply of Nile water via the aqueduct in which "the water went by slightly sloping channels to the next set of waterwheels and finally to the numerous cisterns of the Citadel". In 1187, for defensive and military purposes, Saladin ordered his vizier, Qaraqush, to dig a deep well (90 m) to store the drink water as a protection measure for the army and soldiers during militarily siege. The Well is located in the eastern corner of the Mamluk Sultan el-Naser Mohamed Mosque. It contains two sections; the upper one has a spiral shape-staircase to provide access to water-carrying donkeys and an animal-powered wheel Saqiyah. (AlSayyad, 2013), (The Supreme Council of Antiquities, 1998), (Williams, 2008) & (Yeomans, 2006)

5- National Police Museum: The National Police Museum was

DOI: http://doi.org/10.24086/aces2020/paper.264

the residence of the governor of Muhammad Ali Pasha, his family, and his harem. It was used as a palace until the British occupation came to Egypt in 1298 AH / 1882AD. The palace was converted into a headquarters for the military ruler of the British army and then used as a hospital for the British occupation forces, until the Egyptian government recovered it During the reign of King Farouk I in the year 1946 AD, the Egyptian flag was raised in it and since that date he was subject to the Committee for the Preservation of Arab Antiquities, then the Ministry of War assumed it and prepared it to be a military museum. (Williams, 2008)

8- Royal Carriage Museum: It was founded by SCA for displaying the royal carriages with the history of Mohamed Ali Pasha‟s family. It contains human size-statues expressing the nature and official form of individuals of Mohamed Ali Pasha‟s family. Moreover, there is a magnificent fresco that depicts the 1869 opening event ceremony of the Suze Canal. (Supreme Council of Antiquities, 1998).

courtyards. The palace consists of three main wings consisting of two floors, which are the eastern wing and the middle wing and the western wing. The eastern wing is in turn divided into two main parts, which are guard buildings, and it starts from the main entrance and residence palaces in the back part of this wing. The western maritime side of the castle is occupied by the so-called palaces of the Three Sanctuary, which overlooks the mountain of Mokattam, the wood, and the door of the runway (the entrance to the castle). It has now been demolished, making the garden unfold in front of the central palace, and these three palaces are almost identical in layout. (Wikipedia Encyclopedia, Cairo Citadel)

7- Haram Palace: This palace is located inside the military section of the Salahuddin Al-Ayyubi Castle in the northwestern part of it, overlooking Mount Muqattam and the Al-Hataba area. This palace was ordered to be built by Muhammad Ali Pasha in the year 1242 AH / 1826 AD as stated in the foundational text board installed on the main entrance to the pavilion East. This palace was designated as

DOI: http://doi.org/10.24086/aces2020/paper.264

theater open to become one of the castles Cultural Egypt, where Cairo Castle with the sprawling creek is under it, especially in the northeastern side and its downhill towards the aesthetic and Hussein, then on its western side descending to Salah al-Din Square until the Imam Shafi'i Mosque is an unusual effect and a virgin resource for the popular cultural and artistic industry in Egypt.

3- In Cairo, the ancient Cairo Citadel of Salah El-Din has turned into a tourist attraction for Egyptians, Arabs and foreigners in the hot summer nights witnessed by Cairo. This important archaeological area built on a high hill in the face of Mount Mokattam, with the aim of stimulating domestic tourism and maximizing the tourist role of archaeological areas as attractions, and the activities of the forum included cultural, artistic, economic and political activities in which Egyptian and Arab publishing houses participated and Foreign and provided the musical and musical concerts, theatrical performances and film as well as seminars and meetings, which was attended by many officials.

9- Antiquities Garden Museum "Mahka el-Qal'a": In front of the Royal Carriage Museum, there is a great open-air museum which was founded on the ruins of an old garden. It displays numerous and varied Islamic objects such as columns, capitals of columns, pottery, and heads of minarets that date back to the Ayyubid, Mamluk, and Ottoman eras. The majority of these objects are decorated with Kufic inscription and ordinary Arabic writing. (Supreme Council of Antiquities, 1998)

3- Urban development strategies for Salah El-Din Citadel

1- The Aga Khan Cultural Foundation has provided $ 120,000 to restore the walls of the Salah al-Din Ayyubid fortress in Cairo, which was previously discovered three years ago, and more are expected to be discovered in the coming years.

2- As a unique site of cultural production about ten years ago, exploring the potentials of Salah El-Din Citadel - which is now more than 600 years old - began to transform one of the many garbage dumps that were scattered behind its walls into a "woven" castle similar to a vast semi-circular

DOI: http://doi.org/10.24086/aces2020/paper.264

spaces and indirectly accessed spaces. Space is symmetrical in its relationships when it is directly related to all other spaces, and asymmetric in its relations when it is separated from other spaces by spaces that control the way to it. Here (Hillier) indicates an important characteristic of the urban structure is the property of depth, which must pass through a third space, which may be a separating or transitional space for passing from one space to another, which increases the depth between the two spaces. Symmetrical syntax if the correlation diagram is symmetric. (Al-Haidary, 1996) & (Al-Hankawy, 2004)

- Second: Diffusion - non-proliferation

This characteristic expresses the structural properties of urban spaces, and refers to the distinction in space relations with more than one space or with one space that controls movement, so space is widespread in its relationships when there is more than one way to reach it, and is not spread when it is determined by one way to reach it. The urban structure is not widespread as long as its connection to the external environment determines only one path instead of several methods, and this feature is completely independent of the symmetry property and gives an idea of the extent of the choice that the urban structure offers to distribute

4- The Sariyat al-Jabal Theater in the Citadel witnessed a children's choir showing Egyptian palaces of culture along with many other theatrical performances, while the cultural cafe managed to attract large numbers of audiences, especially young people, to talk about the concerns of the nation, the nation and the world in a similar way to what happens in Hyde Park in Britain. (Abdelhamid, 2009) & (Amer, 2015)

4- Urban Structure Analysis (Theoretical Framework)

Urban structure is analyzed according to two important steps: (Al-Hankawy, 2004)

1- Representing the holistic urban structure based on the basic elements (urban spaces) and the spatial relationships that link them.

2- Linking these spaces to the preparation of (link scheme).

There is a set of basic structural rules that regulate the urban form or space system within which society is included, depending on the structural approach that indicates the congruence between the space structure and the social structure (Identified by Hillier) which are:

- First: symmetry – asymmetry

This characteristic expresses the structural properties of urban spaces, and indicates the distinction between directly accessed

DOI: http://doi.org/10.24086/aces2020/paper.264

of the urban structure is measured by the sum of its axis lines.

- Second: The humpback scheme

It is a method for expressing the urban structure in a contractual form (beady), consisting of the fewest number of the most hoarded spaces that cover all parts of the urban structure.

- Third: Isovist diagram

Which describes the extension of the visual field that can be seen from the vanishing of one, and expresses the optical flow that determines the behavior of the movement of people in the urban environment, and overlaps the fields of vision with each other to represent the urban structure comprehensively.

The pivotal plan that provides the holistic expression of the urban structure will be adopted with the possibility of localized measurements, so the pivot diagram to represent the urban structure is comprehensively and locally and can be measured with the GIS 3.3 program (Arc Veiw).

4-2 Structural properties (global and local) of axial spaces - Elements included in the measurement

1- Step Depth: found relative to the pivot map, which is the depth of the Axial & Visual Step Depth, which is found relative to the vision map, patterns of movement between its parts. (Al-Haidary, 1996) & (Al-Hankawy, 2004)

4-1 Method of analysis

The method known as (Alfa Analysis) adopts the graphic expression of the structural relations of the urban structure and is represented by the synthetic relationships between the urban spaces determined by the spatial relationships of the urban blocks, where each point in the urban environment is part of a space that extends with one dimension, and part of the space Convex represents the maximum visual and dynamic extension of space in two dimensions, and it is possible to distinguish between any urban layout and another through one-dimensional and two-dimensional extensions and the pattern of the relationship between the two extensions, and thus the graphic designs approved in the expression of any urban structure can be divided into the following: (Al-Hankawy, 2004)

- First: the pivot chart

The pivot chart represents a method for expressing the urban structure in a linear manner and expresses the maximum visual and kinetic extension of any point in the structure with one dimension. The plan consists of the lowest number of axial lines and the straightest lines that cover all spaces of the urban structure, and the size

DOI: http://doi.org/10.24086/aces2020/paper.264

spaces spread, and they represent the public spaces in any urban fabric. The integrated spaces are related to the so-called (outer space) which is any space point outside the urban fabric. Whereas, the relative asymmetry is a measure of the degree of integration in addition to the amount of space depth and its distance from the original point. By adopting (Arc View GIS 3.3) we can reach numbers that determine the degree of space integration or isolation. Integration values are between (0–1), numbers that are close to (zero) refer to shallow spaces which have a high degree of integration. Figures close to (1) denote deep, isolated spaces with high privacy. (Al-Haidary, 1996)

B- Segregation Core: The degree of isolation indicates the privacy that space attains in relation to other spaces and this depends on the location of the place, the number of spaces and the paths leading to it, and how the spaces are grouped together. (Al-Haidary, 1996) & (Hillier & Hanson, 1984) The holistic segregation core represents the less symmetrical parts in its structural relationship with the rest of the urban structure, and the where integration and the amount of depth of the region relative to other regions appear dynamically and visually. (Turner & Pinelo, 2010)

2- Global Measures: It includes a group of structural characteristics at the holistic level resulting from the holistic correlations of spaces in the pivot chart, which are as follows: (Al-Hankawy, 2004)

A- The Global Integration Core: The feature of holistic integration is an indicator to measure the degree of total symmetry of the urban structure, as it determines the degree of depth of the parts of the urban structure in relation to the external environment. (Hillier & Hanson, 1984). The core of holistic integration marks the most symmetrical and permeable space in an urban structure that facilitates movement between parts of the structure from the outer periphery. Thus, it can be used to represent the urban infrastructure center that encourages the extension of public use and thus reflects the underlying rules and deep structure. (Al-Hankawy, 2004) The degree of integration depends on the depth property, as the integrated spaces refer to the shallow symmetrical

DOI: http://doi.org/10.24086/aces2020/paper.264

way to move between parts of the urban structure is by relying on mental plans and experience gained from continuous use. (Al-Haidary, 1996) & (Hillier & Hanson, 1984) The core of the holistic choice reflects the direction of the urban structure, and indicates the direction of distribution of movement between its parts, it expresses the most dominant spaces for the movement of total residents between the parts of the urban structure and the direction of the outer limits (Y) and represents the shortest path that the residents take during the transition from inside to outside the urban structure, Thus, the direction of urban structure can be read from the length of the core of the choice between its parts. (Al-Hankawy, 2004)

D- Total Depth: The concept of depth refers to the depth or shallowness of spaces relative to the building or to outer space, where space depth explains the amount of integration of spaces directly with other spaces or the amount of isolation it indicates the nature of space relations between the spaces. Through the space depth diagram, it is possible to discover the amount of space depth, the number of relationship between the nucleus of integration and insulation indicates homogeneity in the distribution of structural properties between parts of the urban structure, and symmetry and homogeneity can be read from the compatibility of the distribution of the nucleus of the insulation relative to the center of the urban structure (the nucleus of integration)) And in different forms that it takes and vice versa, where the center of the urban structure (the nucleus of integration) can be considered as a reference for organizing the comprehensive structural characteristics of the urban structure. (Al-Hankawy, 2004)

C- The Global Choice Core: the degree of the choice is an indication of the degree of control achieved by space over the permeability of the adjacent spaces and the spread of movement between the parts of the urban structure in a comprehensive manner. The more choice spaces represent the shortest path that connects the parts of the urban structure with each other and with the external perimeter, and the shortest path means the least number of steps and the most direct and the simplest axis. The shortest

DOI: http://doi.org/10.24086/aces2020/paper.264

inhabitants and define their space spatialities. It includes the following characteristics:

A- The Local Integration Core (3-Integration): The Local Integration feature expresses symmetry in the structural relations of spaces locally, and to give additional more accurate and deep analyzes of the urban structure locally, the degree of local integration is calculated in the same way that comprehensive integration is calculated but with the adoption of three Synthetic steps in the pivot diagram. (Al-Hankawy, 2004)

B- Local Control Core: Local control core expresses the degree of choice that space provides for adjacent spaces directly in motion and expresses the spread of positional events to residents. (Hillier & Hanson, 1984) The positional control nucleus includes the most dominating spaces of the locational movement between the parts of the urban structure, which contain the fixed social activities of the inhabitants. The locus of control of the locus of control refers to the spaces with the highest choice of movement in relation to its neighborhoods on the positional scale. Thus, the locus of the locus of spaces that must be passed through to a specific space, how the spaces are related to each other, and the number of rings in the space system. (Al-Haidary, 1996) & (Hillier & Hanson, 1984)

E- Global Control Core: The compatibility between the properties of holistic integration and localized control expresses the nucleus of totalitarian control, as the parts of the urban structure that achieve the highest symmetry in their structural relationships and the highest control over local motion, and from the link between the values of integration and control can explain the homogeneity of the distribution of properties Comprehensive, topical structure and degree of uniformity of the relationship between localized spatialities in the center of urban architecture The degree of holistic control achieved by the structure indicates its localities. (Al-Hankawy, 2004)

3- Local Measures: These include the structural characteristics of axial spaces, which indicate the characteristics of urban space in relation to the habitat of the inhabitants, and the spaces that contain the special activities of the

DOI: http://doi.org/10.24086/aces2020/paper.264

while values that approach (zero) represent weak clarity or ambiguity. (Al-Haidary, 2008) & (Hillier, 1993)

5- Measurement (Arc View GIS)

Computer numerical program was adopted for the analysis and elements measurement of the practical study. Arc View GIS is a software of the (GIS) system, and it is one of the programs issued by the company (ESRI) acronym for the Environmental System Research Institute, a company that develops the geographic information system. Among the advantages of the program is that it is easy to analyze the scheduled data and organize this data geographically so that it gives the researcher the ability to visualize, discover, interpret and analyze spatial data, and also allows the presentation of data as maps, tables and interstitial charts. One of the added functions (extension - Ax woman) has been approved to the Arc View program, and the purpose of the program is to access mathematical indicators and numbers that define the characteristics of space organization and its comprehensive and topical relationships. (Al-Haidary, 2008) This program was used in the urban analysis of the study area where (Arc View) analyzes urban spaces and explores control of the locus can be used to express the locale of the occupants on the parts of the urban structure. (Al-Hankawy, 2004)

C- Connectivity: the sum of the number of axial lines that link to a specific axial line and away from it with a single visual and kinetic step. (Al-Haidary, 1996) & (Hillier & Hanson, 1984)

D- Local Depth (3-Depth): The amount of space integration with other spaces is expressed or localized in relation to three optical or kinematic steps in the axial pattern and is calculated in the same way as the total depth. (Hillier, 1993)

E- Legibility: represents the relationship between the holistic scale and the local scale and indicates the ability to accommodate the structure of the space system from local and inclusive space links where all of the parts can be read in the system with strong clarity and vice versa in the system with weak clarity, and the clarity is found from the relationship of integration values with correlation values By means of a parameter (Pearson), the clarity increases as its value approaches (1) where it represents high clarity,

DOI: http://doi.org/10.24086/aces2020/paper.264

which is based on an information structure to provide the graphic components of the method of space composition in order to support the morphological analysis of the urban structure, where three appear The basic functions of the program in drawing, calculating and analyzing according to the axial plan of the urban structure, as the axial diagram is drawn within (View), while calculating the values is within (View) charts and tables, and the analysis is within graphs and tables.

The program calculates the values of the structural properties according to the following stages:

1- Drawing the axial diagram after inserting the studied site diagram into the computer via satellite images from (Google Earth).

2- Calculating the values of the structural properties (comprehensive and topical integration, correlations, control, depth).

3- Organizing the values in statistical tables compatible with the program (Microsoft Excel), where the values of the correlation coefficient (r) are calculated between the relationships and the preparation of graphs.

4- The value of the holistic option is calculated on the charts, because the property indicates the shortest path that the inhabitants take in their daily movement between the main parts of the structure, and it must be determined locally first and then their structural rules. The problems that can be solved by using this program are:

1- Prediction of important traffic systems in the city or site through local integration.

2- Discover the amount of similarity or difference between the local areas and the site as a whole.

3- Discovering the paths that the inhabitant and the stranger move through, through the congruence between the integration nuclei and the nuclei of control, and this gives the degree of choice.

4- Discovering the sites that control the movement of the inhabitants through the control core.

5-1 Application of space structure rules within the technology (GIS)

Space analysis is one of the important characteristics that distinguishes the GIS programs that aim to study and analyze patterns of urban structures based on their space structure. The GIS program offers great potential for compatibility with other approaches to space analysis and representation to achieve its goal as a tool with general objectives for environmental and urban planning. The compatibility between the geographic information system (GIS) and the method of space composition is achieved through the add-in (AXwoman) to the program (ARC View),

DOI: http://doi.org/10.24086/aces2020/paper.264

knows the localities in the urban structure.

C- Connectivity Indicator: The number of pivot connections for the pivot chart

D- Local Depth Indicator: The degree of space isolation over three visual and kinematic steps

As follows:

1- Integration core and insulation core:

The results of the axial pattern of the region showed the highest integration value of (0,860) for the axial spaces represented by the integration core as public spaces consisting of percentages (10% - 15% - 25%) of the most integrated spaces in the system, which include the following axial spaces: 10% (0,718-0,860) - 15% (0,575-0,718) - 25% (0,432-0,575).

While the isolated spaces with the lowest integration value reached (0.289), which is the last 50% of the axial spaces whose value ranges between (0.289-0,432), which represent the convergence surfaces of the movement restricted to the area of the fence that surrounds the castle, as well as the residential parts far from the integration core. The results indicate that the genotype of the period that emerged is a tree system over which the castle spaces are distributed. (Fig.1) & (Fig. 9 from appendix)

2- Choice core indicator:

data processing in the program (Microsoft Excel).

6- Discussion and Results

The results of the analysis include:

1- Indicators of comprehensive structural features that include:

A- Integration Core Indicator: which defines the center of urban structure in terms of symmetry in structural relationships.

B- Option Core Indicator: which determines the direction of the spread of traffic between parts of the urban structure and determines the direction of the urban structure.

C- Space Depth Indicator: A measure that identifies deep spaces on the holistic plane of the space system of a pivot chart.

2- Structural characteristic indicators of a localized structure that includes:

A- Local Integration Indicator: determines the most integrated spaces at the local level and for three visual and motor steps and expresses the degree of space control over the permeability of the local movement.

B- Local Control Indicator: It defines the spaces most controlling the spread of movement locally and

DOI: http://doi.org/10.24086/aces2020/paper.264

from all spaces of the system, as these spaces do not provide any degree of choice in moving to other spaces, and this was in a very small way as well. (Fig. 13 from appendix)

3- Space depth:

The pivot chart showed the highest value of the space depth on the basis of a single visual and kinetic step. It reached (5162) that form the deep spaces of the castle represented by the places that approach the surrounding wall in the castle, while the lowest value (1906), which represents the shallow spaces of the castle and is represented by the most integrated axes within The nucleus of holistic integration. (Fig.2) & (Fig. 14 from appendix)

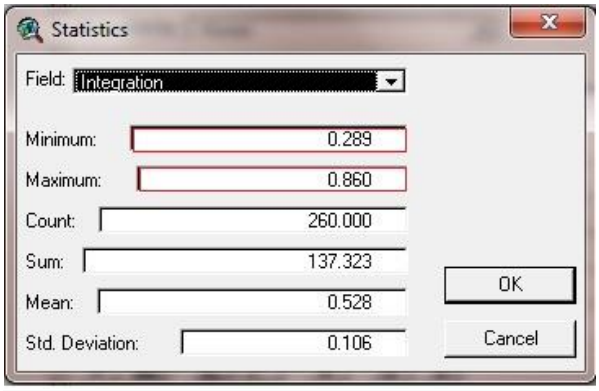

Figure 1: Integration core and insulation core results: (Resource: researchers using ArcView GIS)

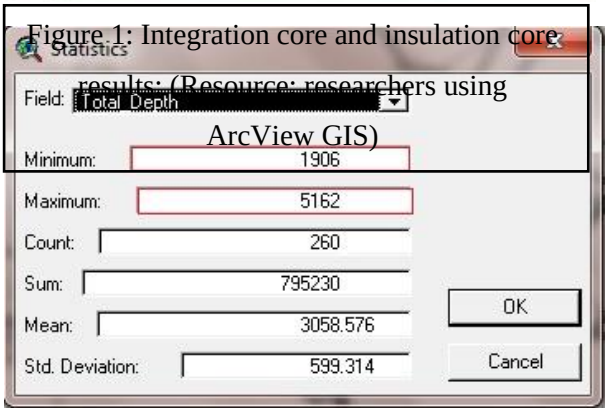

Figure 2: Total Depth results: (Resource: researchers using ArcView GIS)

The distribution of the core of the choice showed a wider extension within the urban structure, as the main axes achieved the highest degree of control over the permeability of the movement between its parts. The axial spaces that make up the nucleus of the choice centered around the axes, along the castle, achieved an indication that the movement is distributed according to a tree system. (Fig. 10 from appendix)

A- Spread control core: The pivot chart showed spaces that provide a high degree of choice in moving through them to the adjacent spaces only and not to all spaces of the system and this is at the comprehensive level of the castle and this is at the entrances and short axes. (Fig. 11 from appendix)

B- Non-spread control core: The system showed non-spread spaces, that is, there are few ways to reach them from other spaces of the system, and thus these spaces express the availability of a small degree of choice, but at the same time they control the ways of movement to the adjacent spaces and this was very few. (Fig. 12 from appendix)

C- Inactive control core: The system showed isolated and non-dispersed spaces, as it is difficult to access

DOI: http://doi.org/10.24086/aces2020/paper.264

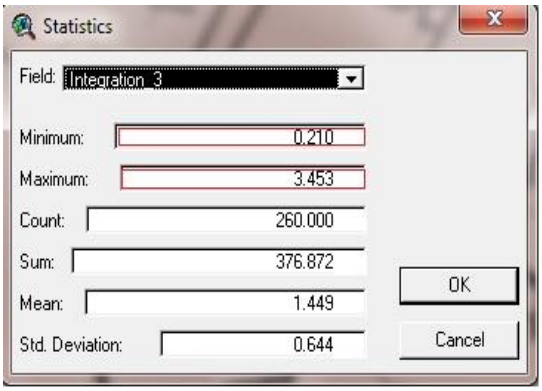

Figure 3: Local Integration results: (Resource: researchers using ArcView GIS)

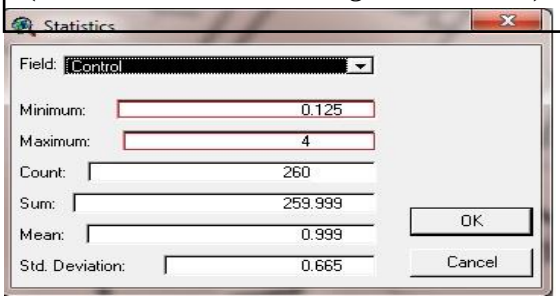

Figure 4: Local Control results: (Resource: researchers using ArcView GIS)

4- Local Integration:

The urban structure achieved the highest local integration value of (3.453), which included the most integrated axes in the castle at the holistic level and the lowest local integration value (0.210), which included the most isolated axes in the castle at the level of local isolation. (Fig.3) & (Fig. 15 from appendix)

5- Local control core:

The results of the analysis of the pivot chart showed that the value of the strong control nucleus ranges between (1-4), which represents 50% of the total control values of the castle's space system, where the most dominating axes appear in the castle in a high manner, which provides a high degree of choice, while the weak control nucleus ranges between (0,125-1) Also it represents the last 50% of all system values. (Fig.4) & (Fig. 16 from appendix)

6- Connectivity:

The pivot chart showed the highest correlation value with a number of axes of (8) in the axis (84), and the lowest value (1) was limited to the entrances to the buildings in the castle. (Fig.5) & (Fig. 17 from appendix)

7- Local depth:

It is a measure of the space depth of the axial spaces on the basis of three optical and kinematic steps, where the highest value (41) represented in the axes (14-84-86-108), while the lowest value (3). (Fig.6) & (Fig. 18 from appendix)

DOI: http://doi.org/10.24086/aces2020/paper.264

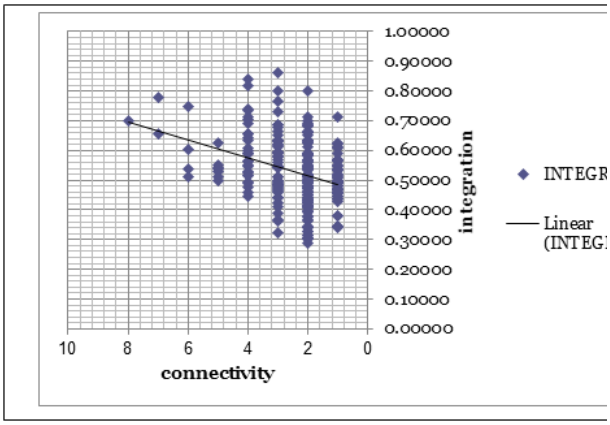

Figure 5: Connectivity results: (Resource: researchers using ArcView GIS)

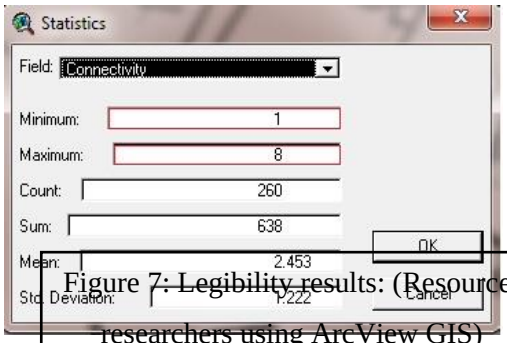

Figure 6: Total Depth results: (Resource: researchers using ArcView GIS)

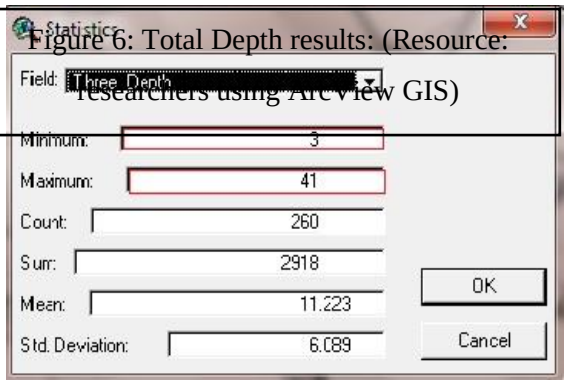

Figure 7: Legibility results: (Resource: researchers using ArcView GIS)

7- Conclusions

1- Castles are considered one of the most important defensive installations that appeared in the Middle Ages, especially in the Ayyubid era, in which defense and defense architecture flourished, especially castles, towers, and fences.

2- It has become a prominent archaeological monument of Islamic civilization in the eras of power, which still exist today in some Islamic cities to attest to the progress, glory, and prosperity of defensive architecture during previous ages.

3- Benefiting from the foundations upon which the Islamic castles were constructed as part of the urban design process for modern cities in terms of choosing the appropriate site and the correct orientation, in addition to the self-fortification the site owns.

8- Legibility:

The relationship between the integration values and the correlation values was analyzed using (Pearson coefficient) and it became clear that the system's clarity has reached (0.346), which indicates a weak positive relationship, and this indicates a little clarity in the castle.

DOI: http://doi.org/10.24086/aces2020/paper.264

2- Al-Haidary. Sanaa S. (2008). “Change in the genotype of ancient heritage areas - an analytical study using GIS technology”. Iraqi Journal of Architecture & Planning. University of Technology. Issue: 14 & 15.
3- Al-Haidary. Sanaa S. (1996). “Spatial affiliation in residential areas". University of Technology. Baghdad. Iraq.
4- Al-Hankawy, Wihda (2004). “The Impact of Intellectual Attitudes on Urban Structure - An Analytical Study of the Structural Characteristics of Urban Structure”. University of Technology. Baghdad. Iraq.
5- Al-Hankawy, Dr.Wihda. & Al-Kubaisi Shymaa (2010). “The Strategy of Urban Development of The Citadel Cities - Comparative study between design strategy of the development of the citadel of Aleppo and the citadel of Erbil”. Iraqi Journal of Architecture & Planning. University of Technology. V.6. Issue: 19-20-21 P.309-326.
6- Al-Sayyad, Nezar (2013). “Cairo: Histories of a City”. Harvard Collage. USA.
7- Amer, Mohamed, B. (2015). “Developing Innovative Marketing

4- At the level of the characteristics of the totalitarian system, we see the nucleus of totalitarian control and the comprehensive integration of the axial spaces, which provides a high degree of choice and spread to the rest of the castle spaces.
5- The visual relationship between the location of the castle and the surrounding neighborhoods provides an urban scene indicating the power and the power in force. As for the physical, the diversity of forms and architectural details are all gathered within the framework of one unit within one link, which is the wall surrounding the castle.
6- Muslims' interest in open spaces and outer spaces through the design of patios and gardens (green spaces) as well as self-sufficiency and comfortable lifestyle, and this is what came in sustainable architecture.

References

1- Abdelhamid, T. Galal (2009). “The Citadel of Cairo in the Ayyubid Period and the Development of Thirteenth-century Fortifications: A Reconsideration”.

DOI: http://doi.org/10.24086/aces2020/paper.264

Museum, the Museum for President Mubarak's Gifts, the Silverware Museum". Ministry of Culture. American University in Cairo Press.

15- The Supreme Council of Antiquities, (2010). Ministry of Culture.

16- Torky, Tarek (2020). "Citadel of Salah al-Din al-Ayyubi" in Discover Islamic Art, Museum with No Frontiers. http://islamicart.museumwnf.org/database_item.php?id=monument;isl;eg;mon01;8;en

17- Turner, Alasdair, & Pinelo, Joao (2010). " Introduction to UCL Depthmap 10". London.

18- Wikipedia Encyclopedia, Cairo Citadel, https://en.wikipedia.org/wiki/Cairo_Citadel

19- Williams, Caroline (2008). "Islamic Monuments in Cairo – The Practical Guide". Sixth Edition. The American University in Cairo Press. Cairo - New York.

20- Yeomans, R. (2006). The Art and Architecture of Islamic Cairo. Reading, UK: Garnet Publishing.

Plan to Augment the Visitation of Egyptian World Heritage Sites: A Case Study on Saladin Citadel".

8- ARCHNET website https://archnet.org/sites/218

9- Egypt State Information Service - Islamic Antiquities https://www.sis.gov.eg/section/10/4428?lang=ar

10- Grandin, Thierry (2008). The Castle of Salah ad-Din: Description, History, Site Plan and Visitor Tour. Syria: Aga Khan Trust for Culture and the Syrian Directorate, General of Antiquities and Museums.

11- Hillier, B. (1993). "A partial Content of the Ascent from Building as Cultural Transmission to Architecture as a Theoretical Concertation". Harvard Architectural Review. Spring.

12- Hillier B., & Hanson J. (1984). "The Social Logic of Space", Cambridge University Press. Britain.

13- Riental tours Egypt website https://www.orientaltoursegypt.com/tour/cairo-day-trips-to-salah-el-din-citadel-and-city-of-the-dead

14- The Supreme Council of Antiquities, (1998). 'Abdine Palace Museums: The Military

DOI: http://doi.org/10.24086/aces2020/paper.264

DOI: http://doi.org/10.24086/aces2020/paper.264