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Holographic Maps of Earth's Uses of Morphological Phases of Nasiriyah (1869-2023)

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Abstract

Many urban processes interact, ultimately affecting the city's morphology, as well as human activity, land uses, and urban form, to varying degrees.Nasiriyah, an Iraqi city, is one of many locations around the world that has seen substantial modifications to the map of urbanization and the shape of the city. The purpose of this study was to analyze the shape of the city of Nasiriyah using three-dimensional maps and build a cartocarbon model by collecting and analysing data on land use sites, shape and structure using modern geographical techniques, in light of the fact that geographical factors influenced the city's growth and development, and the descriptive analysis was carried out to achieve the objectives of investigation and solve the problem. The current distribution of neighborhoods was assessed using Arc Map 10.8.2. The research examined the city's history, development and internal structure, as well as the compatibility of these plans with land uses. The problem was investigated and solved using descriptive analysis and historical approaches. Arc Map 10.8.2 has been used to assess the current distribution of land-use sites, and to detect spatial relationships between them providing digital maps that are 3D in nature and designed to interact with the user. These maps are capable of updating the geographic database of 3D maps with varying levels of research information. Use these three-dimensional models to monitor changes in the morphological stages of the study area. 3D modeling is able to represent information in three dimensions, this ability enables a more realistic and detailed representation of the city.

Keywords: *Morphology; 3D; Development; History.*

Introduction

In recent years, the development of 3D models has become increasingly widespread in a variety of scientific fields, including urban and environmental planning, as well as demographics. In addition to providing a three-dimensional perspective of the depth of the geographic area, this type of model is vital for understanding geographical data for the reasons mentioned above. In the field of scientific study based on geospatial data examination, the use of 3D models for conferences is of paramount importance. The importance of 3D models in obtaining a full and accurate understanding of geographical and environmental phenomena is a common reason for the widespread use of this application. Visual data, information from government agencies, basic design maps and television visuals were used to analyse luminous spectroscopy and spatial reflection in urban land uses. This has been achieved through the use of Quick Bird2 satellite data in conjunction with the SAS.Planet.Nightly.2023 program.

The results of this research indicate that urban development within the design boundaries of the city of Nasiriyah improves the economic conditions of the region and reverses the effects of this significant rise on the city's large land uses. The integration of geographical information, topographical maps and justice surveys is among the sources falling under this category. An example of such programs is Arc Map 10.8.2 a series of programs, most notably Arc Scene 10.8.2, which provides automated methods for the delivery of 3D models, and for the construction of a specialized database for investigation.

Search Problem

The main research problem is the following question:

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Can a geographical database of the study area be created to create 3D maps depicting the city's morphology and indicating its growth trajectory using simulation techniques?

Can 3D models be created and thematic maps be used to generate them in order to create cognition?

Can the data model be relied upon to create 3D maps showing details within the urban area?

Research Hypothesis

First hypothesis: the use of modern software that analyzes data and the creation of three-dimensional models.

The second hypothesis for achieving understanding and cartographic perception can be the creation of three-dimensional models using thematic maps and space visuals.

Third hypothesis: The use of three-dimensional maps in the morphology analysis of the city of Nasiriyah contributes to a deeper understanding of its topography, natural formations and general structure.

Research Objectives:

This research aims to build a three-dimensional database of different degrees of research field information and use it to track morphological phase changes in the study area, allowing a more realistic and detailed picture of the city.

Search Limits

Spatial boundaries: the city of Nasiriyah is determined between two exhibition circles (5:30 - 10:31) North and linear (10:46) East, which is the centre of the governorate of Dhi Qar, its administrative borders with the governorate as it is bordered on the north side by the Grave and on the west by the Batha and on the north east by the Syed Dakhil and on the south side by virtue and occupying an area (51,1,843) hectares, which includes (64) residential areas, looking at map (1).

Time limits: The historical background of the city of Nasiriyah, which dates back to 1869, was taken into account. The study also covers the urban development it has experienced and its current state. The research also assesses the phases of the urban development of the city and the spatial compatibility of the city's current expansion patterns during 2023.

Map (1) Nasiriyah City Location from Dhi Qar Governorate and Iraq

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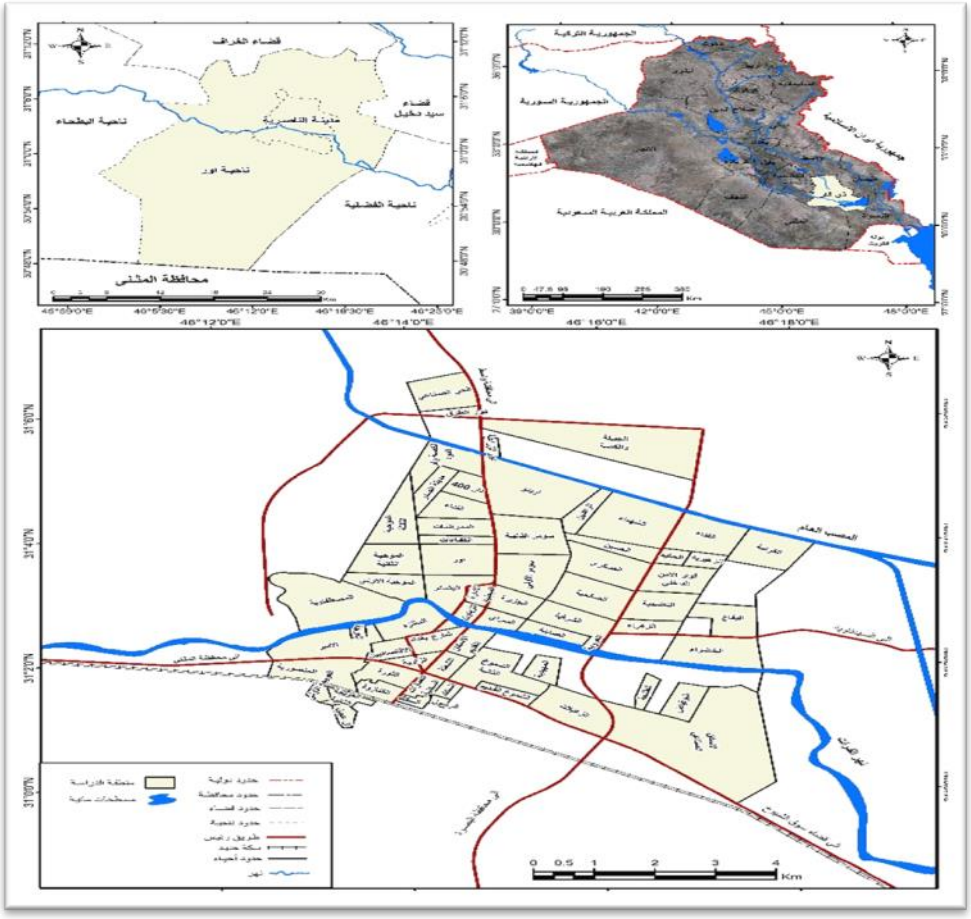

Research Source Based On

Ministry of Water Resources General Survey Department Iraq's Administrative Map on a scale 1000000/1 Baghdad 2023 and Dhi Qar Governorate Administrative Map on a scale 500000/1

Ministry of Water Resources, Public Space, Map Production Section, Dhi Qar Governorate Administrative Map, 500000 Scale: 1, Baghdad

3. Arc Map 10.8.2 and Basic Design Map Ministry of Ages and Housing Municipal Directorate of the City of Nasiriyah on a 100000/1 scale of 2023.

Map (2) Map of Nasiriyah City 2023

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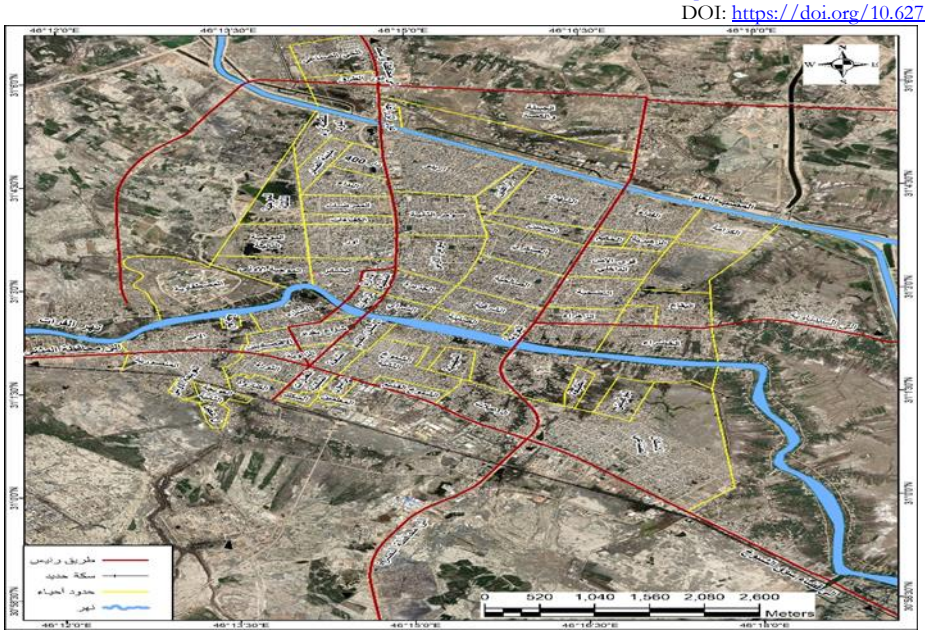

Source: Researcher based on: Space Visual Ministry of Ages and Housing Municipal Directorate of Nasiriyah, 2023.

First, The Concept Of 3D 3D Maps

3-D virtual representation of the Earth, surfaces, objects and phenomena in nature and society is what 3D maps represent. This technology is unique and powerful, allowing for a more accurate and realistic portrayal of the world. A particular goal is taken into account when classifying, designing and visualizing phenomena that are represented (Hajek, 2016).

When it comes to the world of contemporary geographical graphics, 3D maps not only impress us, but also inspire our awareness of the site in all its dimensions. The realistic and comprehensive representation of the spatial environment is a reflection of this technique. In addition, "3D mapping technology provides us with new prospects for exploring the environment in a way we never dreamed of before", one of the definitions of a 3D map describes it as "a portrayal of the three-dimensional space universe in a realistic way." Because users are able to interact with the environment and objects as if they were in the physical location, these maps offer a similar experience to reality in all three dimensions (Foldable, 2003).

The ability to display differences in height as well as geographical distribution of terrestrial shapes and events is one of the basic functions of 3D maps. Understanding the spatial links between terrestrial shapes and phenomena requires a basic understanding of the concept of 3D models. The use of dimensions (X, Y, Z) enables the geographical distribution of Earth's forms and phenomena, as well as trends in their impact on the three-dimensional shape, and spatial analysis of these phenomena. It is possible to create a 3D model using specialized drawing tools such as Autodesk Revitf, Esri City Engine, SketchUp, Bentley Map, Vectorworks Architec, Blender2, ArcScene and ArcGIS. The researcher relied on the Arc Scene program as it is a program affiliated with the Arc Map program and features the ease of producing maps in it in a simple and understandable way for the reader. Reality Studio, QGIS, and Global Mapper were also taken into account (David, 2012).

Second, the importance of three-dimensional maps in the morphology study of cities

The Morphology of Cities Study, which is interested in analysing the shape and structure of cities, is a vital area in urban urban urban planning and geography· 3D maps are increasingly used to achieve an accurate and comprehensive understanding of urban morphology· These tools help to analyze urban patterns and future planning of cities in innovative and effective ways· (, Petrovic, 2003).

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Third: Three-dimensional map targets

can be included as follows (Hamed, 2024)

- Getting a better understanding of spatial communications: Since 3D maps provide a three-dimensional visual view of the city, they facilitate understanding of the spatial links between buildings and other structures. This makes it possible to conduct an examination of how the height of buildings and the layout of urban blocks affect air flow and the amount of natural light.

- The use of 3D maps, an effective tool, can significantly streamline urban project design. This is because 3D maps are very visible. Designers can visualize projects in three dimensions before implementing them, improving design and eliminating any potential problems.

- 3D maps can be used to simulate scenarios and assess the implications of expected physical changes. This allows prediction of future developments. Thus, this makes the deliberate judgement process on urban planning and sustainable development easier to implement.

Fourth: 3D Map Design Techniques

- Digital modelling technology: digital modelling technology is used to create 3D models of geographical spaces and that "that technology allows accurate representation of terrain and objects (Kennedy,1993)

- Use of 3D GIS: GIS can be 2- used to create 3D maps. GISs provide tools for 3D analysis and representation of geographic data (Macie, 2006).

- Lighting techniques and visual effects: the success of 3D maps depends on lighting techniques and visual effects to achieve greater realism and that "those technologies contribute to enhancing the user experience" (DeFanti, 1993).

Fifth Software used to create 3D mapping technology

Arc Scene is a three-dimensional visualization application that allows Arc Scene to display data in a three-dimensional environment, enabling GIS to provide elevation information from milestone engineering and layer characteristics. Acts as a reader and exhibitor of cartographs, 3D allows data to be analyzed differently in a display that enables ArcScene to fly over maps and graphics, and can be combined with the geo-processing environment to access analytical tools and functions, looking at an image (1).

Image (1) Arc Scene software interface

Seventh: Morphology of the City

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The visual component (Townscape) is created through a combination of function and shape, and city morphology can be defined as the field of study that studies the origin and evolution of urban structures in cities, countries and villages. It focuses on analysing the spatial arrangements and physical features of these structures at different levels, with a view to guiding sustainable urban development efforts. It includes street arrangement, various architectural styles, land allocation for various urban purposes. The correlation between function and form often presents challenges in determining the overall structure of the city, especially during historical periods when cities evolve based on their previous iterations (Chen, 2021).

The term "morphology" is derived from the Latin terms "morpho" and means "visual form" and "loge", which means knowledge. scholars often combine two passages of Arabic words to create the drain, which is to examine the exoskeleton or shape (Mohammed Abdul Ghani, 2013).

Morphology refers to architectural forms that result from the gradual correlation between function and the surrounding land, ultimately leading to the city's visual interaction and the integration of morphological phases.

Eighth: The role of GIS in the preparation and design of 3D maps of cities

The use of GIS in urban projects offers various services and benefits that enhance municipal planning and management. The use of geospatial information systems in city development offers great advantages. In addition, GIS plays a crucial role in the implementation of the city's initiatives (Hamed, 2024):

- GIS helps in urban planning by providing accurate data on terrain and land use. Planners and decision makers can get great advantages by taking advantage of modern spatial data analysis to ascertain the locations of future projects. As well, this tool can be used to locate suitable for urban infrastructure.

- Resource management: GIS plays a critical role in effective resource management, which is an essential aspect of urban life. Through the use of GIS, GIS may provide reliable consumer assessments and guide sustainable initiatives. In addition, these techniques can assess and assess energy and water use, as well as waste management.

- Immediate reaction in times of disasters, GIS can effectively identify accidents and facilitate the organization of rescue activities. Spatial maps are very useful for understanding events.

Ninth: 3D Maps of Land Uses for Morphological Phases of Nasiriyah (1869-2023)

Land use maps are an essential tool for understanding and analysing urban planning and sustainable development of any city, and the city of Nasiriyah is no exception. Land use maps reveal urban changes and population growth by studying these maps. Residential, commercial and industrial patterns can be identified, as well as areas that need to be developed or improved in infrastructure and services. The city of Nasiriyah has gone through six stages of land use, which can be detailed as follows.

Form (1) Morphological phases of Nasiriyah Land Use City 2023-1869)

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Source: The
Ministry of Municipalities and Public Works (MMPW) prepared by the researcher on accreditation, the baseline plan for the city of Nasiriyah, the strategy for the development and updating of the baseline plan. unpublished data.

Three-dimensional maps of Earth's uses for the first morphological phase of the period 1869-1942

This phase is a pivotal stage in the development of the city of Nasiriyah, where the use of residential land is 59.8% of the total area. The city's commercial center, which includes markets, government departments and some residential units, extends over an area of 5.63 hectares, accounting for 2 .85% of the total city area of 197 .67 hectares. These commercial services include a range of enterprises, including the municipal market, Safat, the fruit market, the vegetable market, the meat market, the yolk market, the Nadafin market and the bazazzin market. The primary focus of these markets is on meeting the needs of agricultural and animal products and fishing for the city's inhabitants as well as those of neighbouring cities. Note map (3), and transport and communications services cover an estimated 35.21 hectares, representing about 17.81% of the city's total area in the initial morphological phase. This can be attributed to the means of transport prevailing in that period, which used primarily animals, manual carriages or wild animal carriages. In addition, the compact design of the urban area and the proximity of residential neighbourhoods to the CBD may have contributed to this phenomenon. Within the heart of the city, transportation is unnecessary, (Atabi, 2018).

Table 1. Earth's uses for the first morphological phase (1869-1942)

%	Space/hictare	Type of use	T
59.8	118.2	Residential use	**1**

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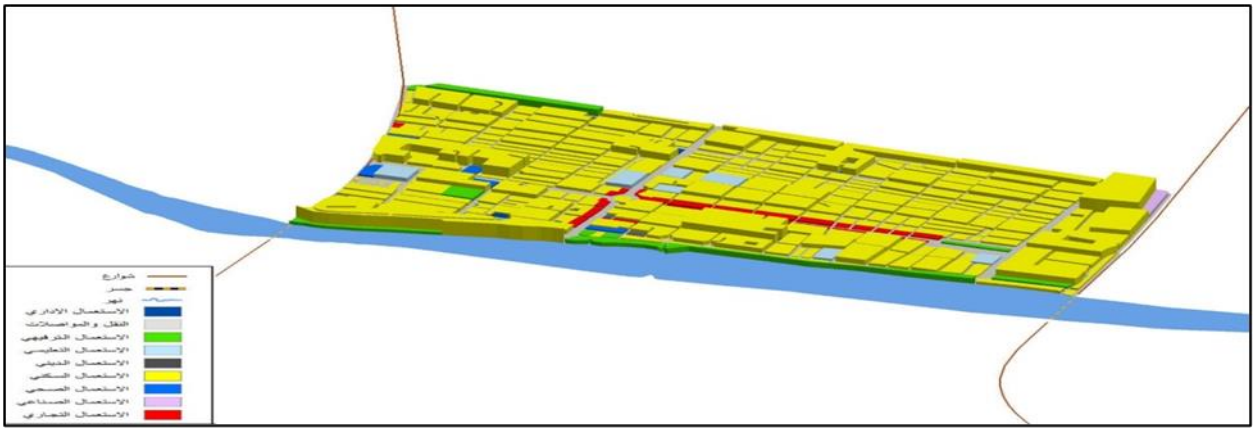
2.85	5.63	Commercial use	**2**
0.36	0.71	Industrial Use	**3**
0.14	0.28	Administrative use	**4**
2.33	4.6	Educational use	**5**
1.70	3.36	Health use	**6**
0.41	0.81	Religious use	**7**
17.81	35.21	Transport and communication	**8**
3.42	6.77	Recreational use	**9**
11.18	22.1	Spaces	**10**
100	**197.67**	**Total**	

Source: Accredited researcher Arc Map 10.8.2

Directorate of the Municipality of Nasiriyah, Department of Planning and Follow-up, unpublished data.

3D map of the Earth's uses for the first morphological phase (1869-1942).



Source: Researcher's work based on Arc Scene 10.8.2

Three-dimensional uses of the Earth for the second morphological phase (1943-1961)

The use of land in this phase has progressively progressed and the mall has expanded the city's land and mall, extending to Baghdad, Basra and other Iraqi cities, where the grain export trade has flourished. (wheat, barley, rice, especially amber) and trade dates, fish and leather to Baghdad and Basra, if noted through the table (2) And map (4) the size of the city has witnessed a significant development from the previous stage, as it has reached its size (526.06) hectare. The residential utilization rate was first (312.87) and 59.47% per cent of the city's area, while transport and communications were second if it reached its size. (94.35) and 17.94% while commercial use came in third place (18.54) By 3.25%, this rise is due to the increase in the city's population and the establishment of a number of shops in the city centre, Nile and the Republic, while religious use was last by 0.03%, the lowest at this stage.

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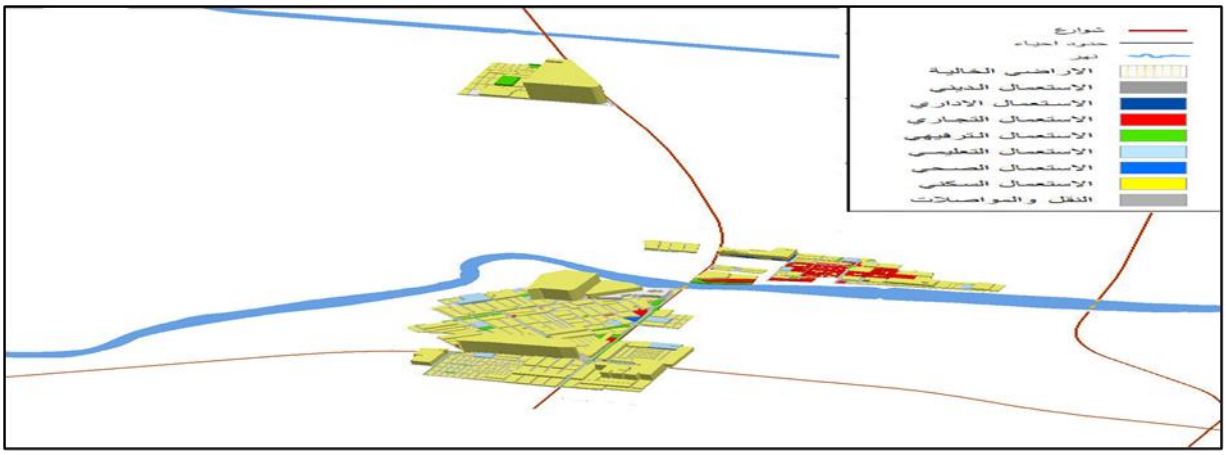
Table 2. Land uses for the second morphological phase (1943-1961)

%	Space/hictare	Type of use	T
59.47	312.87	Residential use	**1**
3.52	18.54	Commercial use	**2**
0.06	0.31	Industrial Use	**3**
0.06	0.29	Administrative use	**4**
2.13	11.2	Educational use	**5**
0.95	5	Health use	**6**
0.03	0.17	Religious use	**7**
2.19	11.51	Transport and communication	**8**
17.94	94.35	Recreational use	**9**
13.65	71.82	Spaces	**10**
100	**526.06**	Total	

Source: 1. Accredited researcher Arc Map 10.8.2

2. Directorate of Nasiriyah Municipality, Planning and Follow-up Department, unpublished data

Map (4) Map of the Earth's Triple Uses of the Second Morphological Phase (1943-1961)



Source: Accredited researcher Arc Scene 10.8.2

Holographic maps of Earth's uses for the third morphological phase (1962-1974)

At this point, the city has grown in every direction, including along the main roads. The mall has grown and evolved as a result of the city's expansion and development. The total area extends to 1845.1 hectares, and the use of the site has evolved to include several functions as well as its commercial purpose, leading

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to a clear integration of various activities within the mall. The area includes mosques, government offices and public toilets.

However, specific areas can be distinguished according to their functions, such as municipal markets and Souq Sa 'ad. These areas serve as the commercial and vital hub of the city, supplying the suburban markets with merchandise (Masri market, Al-Thawra neighbourhood market, Al-Sha 'la neighbourhood market, Sumar neighbourhood market). In addition, their services extend to the city's surrounding areas. The main roads originated in the vicinity. In 1974, a decision was issued to expand the Nile Street from 10 metres to 50 metres and develop commercial and service facilities on both sides of the street (Azerjawi, 2004), looking at map (5) and table (3)

In addition, several judgements have been issued stressing the need to allocate ground roles on Al-Habobi Street (formerly called "Aqid al-Hawa") has changed the name of al-Habboubi in time with the great poet Mohammed Said al-Haboubi) Al-Gorani, 2018, and Nile Street for commercial activities and services, as Al-Haboubi Street was the main location for doctors' offices and pharmacies, while Al-Madhuriya Street was the main area for hotels, restaurants and cafes in Nasiriyah. This illustrates the concept of spatial specialization, and the region witnessed a remarkable economic development after 1972, representing the establishment of a textile and midwifery plant, reflecting a positive picture in social and economic activity (Al-Atabi: 2018).

The mall gave a pattern of urban development different from the first and second stages. The high buildings started with a multi-storey, 25.14 hectares, and a 1.36% rate of residential usage was ranked sixth. (1271.2) and 68.9% of the city's area, while transport and communications came in second if it reached its size (373.3) hectares, 20.23%, while health use came in seventh place. (12.53) hectares (0.68%), while religious use was last at (0.14%), the lowest at this stage.

Table 3. Earth's uses for the third morphological phase (1962 _1974)

%	Space/hictare	Type of use	T
68.90	1271.2	Residential use	1
1.36	25.14	Commercial use	2
0.18	3.34	Industrial Use	3
0.49	9.02	Administrative use	4
2.19	40.35	Educational use	5
0.68	12.53	Health use	6
0.14	2.61	Religious use	7
3.10	57.28	Transport and communication	8
20.23	373.3	Recreational use	9
2.73	50.32	Spaces	10
100	1845.1	Total	

Source: Accredited researcher Arc Map 10.8.2

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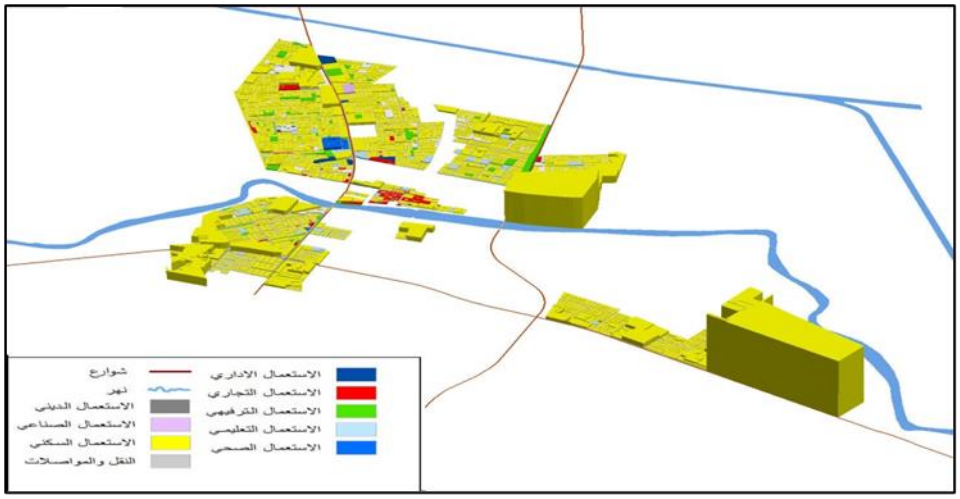
Directorate of the Municipality of Nasiriyah, Department of Planning and Follow-up, unpublished data.

Map (5) Triple Earth Uses Map for the Third Morphological Phase (1962 _1974)



Source: Researcher's work based on Arc Scene 10.8.2 and map (29)

3D maps of Earth's uses for the fourth morphological phase (1975-1994)

During this phase, the city saw the establishment of the Dhu Qar University on the right side near Nasiriyah Stadium On the left side, the cornerstone was laid for the construction of a new stadium in the sacrifice neighbourhood. This period saw a spatial expansion over consecutive periods of time that extended within the limits of the city's basic design and from the neighbourhoods that emerged during this period the Sumerian industrial housing area, residential buildings, Arido, the first chest, as witnessed (Revolution, Internal Security Forces and Mansuriyah) An increase in urban land uses, whether urban, economic or social, resulting in an increase in the number of units (Al-Azirjawi, 2004). At this stage, the construction of some housing units was completed in a number of neighbourhoods completed at the stage preceding this phase, especially since there are a number of Iraqis who arrived in the city and are currently residing in Kuwait after its occupation on 2 August 1990 or after its liberation on 26 February 1991 or large numbers of Kuwaiti citizens. A number of the city's neighbourhoods have undergone a change in their social and urban structure as a result of the drying of the marshes in 1993 (Sahlani, 2009). Table (4) and map (6) show the uses of the land during this phase, noting that the residential use came in first place with an area reaching (1804.5) hectares at 70.65% of the city's area at this point (2554.2) hectares, while transport came in second place (17.17%) Educational use came in fifth place with an area of (69.31) hectares in the proportion of Balat 2.71% and commercial use in sixth place with an area of 41.2 hectares in the proportion of (1.61%) The last-ranked use of religion amounted to (4.24) hectares (0.17) of the city's area at this point.

Table (4) Land uses for the fourth morphological phase (1975-1994)

%	Space/hictare	Type of use	T
70.65	1804.5	Residential use	**1**
1.61	41.2	Commercial use	**2**
0.36	9.19	Industrial Use	**3**
0.75	19.13	Administrative use	**4**

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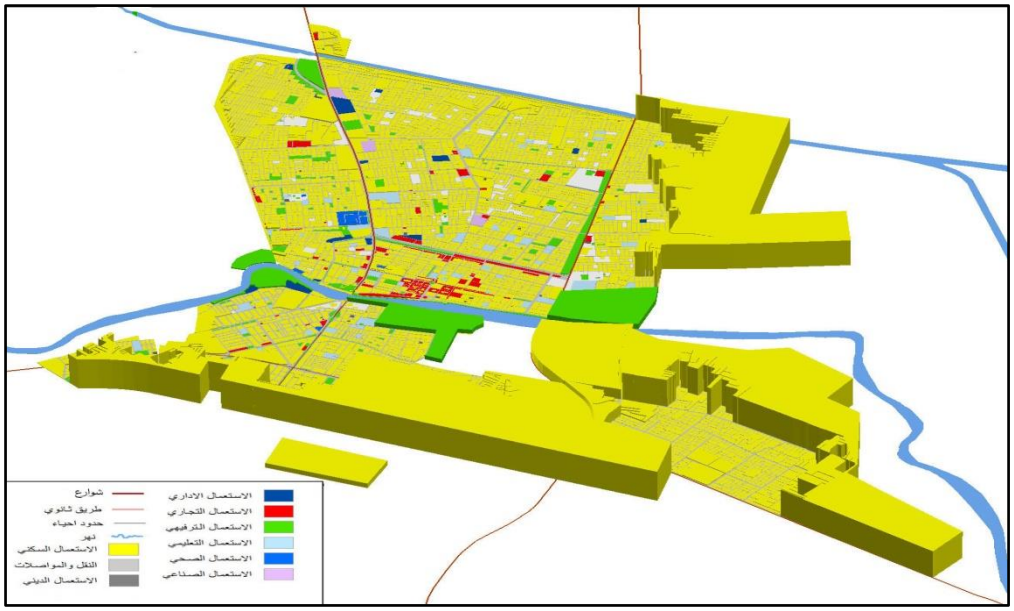
2.71	69.31	Educational use	**5**
0.62	15.72	Health use	**6**
0.17	4.24	Religious use	**7**
2.97	75.93	Transport and communication	**8**
17.17	438.57	Recreational use	**9**
2.99	76.36	Spaces	**10**
100	2554.2	Total	

Source: Accredited researcher Arc Map 10.8.2

Directorate of Nasiriyah Municipality, Department of Planning and Follow-up, unpublished data

Map (6) Map of the Earth's Triple Uses of the Fourth Morphological Phase (1975-1994)



Source: Researcher's work based on Arc Scene 10.8.2

Holographic maps of Earth's uses for the fifth morphological phase (1995-2012)

At this point, the city of Nasiriyah witnessed a significant urbanization due to the change in governance in Iraq and the political changes that took place, which led to an increase in land use areas. Much of Samoud's neighbourhood orchards have been transformed into residential areas, and the military hospital has been built by converting these orchards into residential land. The urbanization of the right side also continued, during which time the military base of the Jerusalem Army was established, as a result of which a sports stadium, power station and industrial preparatory plant were established in Eastern orchards on the river's left bank.

Housing use has also developed considerably, reaching 2052.9 hectares (59.5%), owing to a change in governance in Iraq during this phase and increased urbanization, resulting in the integration of some rural

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enclaves into the urban environment. Industrial use is 92.8 hectares and 2.69%. From the total area of the city as the city has witnessed at this point an activity on the commercial side of the areas of Habubi Street and Republic Street, as the percentage of commercial use at this stage (68.83) hectares (1.99%) The map (7) and table (5) of the land uses for the morphological phase are considered, while the educational use at this stage has reached (131.41) hectares of the area of the city at this point and at 3.8%. 8.91 hectares at 0.26% of the city's total area at this point.

(5) Land uses for the fifth morphological phase (1995-2012)

%	Space/hictare	Type of use	T
59.50	2052.9	Residential use	**1**
1.99	68.83	Commercial use	**2**
2.69	92.8	Industrial Use	**3**
0.81	27.81	Administrative use	**4**
3.81	131.41	Educational use	**5**
1.02	35.13	Health use	**6**
0.26	8.91	Religious use	**7**
6.85	236.32	Transport and communication	**8**
19.17	661.27	Recreational use	**9**
3.91	134.82	Spaces	**10**
%100	5642.3	Total	

Source: Accredited researcher Arc Map 10.8.2

Ministry of Planning, Central Statistical Agency, Dhu Qar Census Directorate, unpublished data

Map (7) Map of the Earth's triple uses for the fifth morphological phase (1995-2012)

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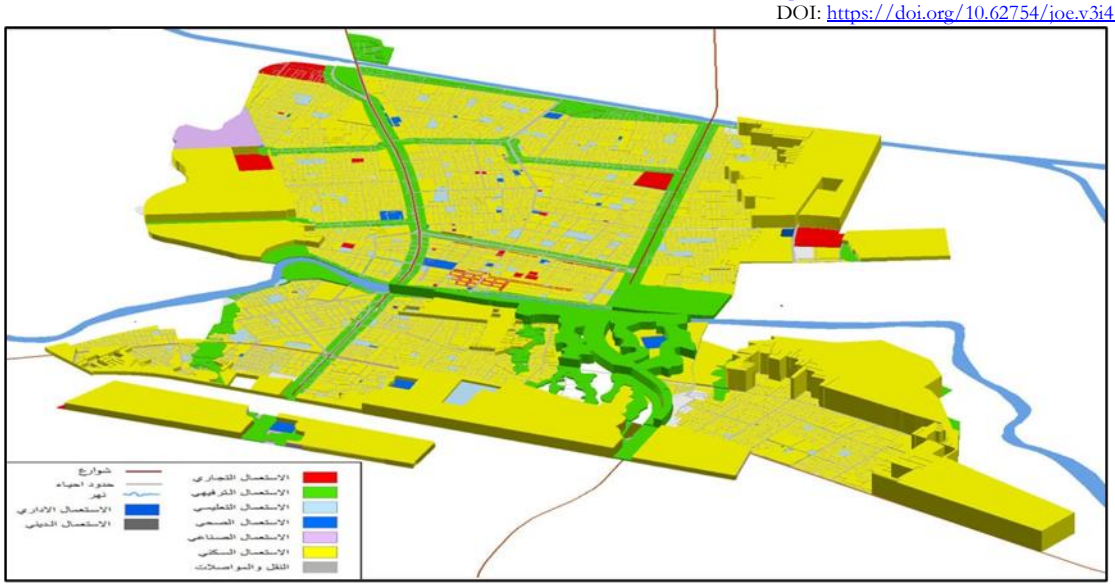

Source: Researcher's work based on Arc Scene 10.8.2

Holographic maps of Earth's uses for the sixth morphological phase (2013-2023)

At this point, the residential use area was 3,049.88 hectares. (58.83%) of the total city area of (5184.3) hectares, which ranked first in usage, not to mention industrial usage, which reached (122.66) hectares (2.37%). The use of land for transport and transportation at this stage is second with an area of (906.42) hectares (17.48%), while educational use is fourth in size. (152.87) hectares, at 2.95%, while commercial use has witnessed a remarkable development during this phase, reaching its size. (117.83) hectares with a ratio of 2.27%, the health use area (66.65) Hectare and 1.29% of the area of study as a result of an increase in the population requires an increase in the health function to meet the needs of the population. Government hospitals in Nasiriyah at this stage include Nasiriyah Teaching Hospital, Hussein Teaching Hospital, Habubi General Hospital and Bint al-Huda Hospital. In addition, community hospitals have been established in Nasiriyah such as Rahman Hospital, Al-Amal Hospital, Al-Azhar Hospital, Al-Rabi 'Hospital Hospital, Civilia Hospital.

Table (6) Earth Uses Carry-overMorphology VI (2013-2023)

%	Space/hictare	Type of use	T
58.83	3049.88	Residential use	1
2.27	117.83	Commercial use	2
2.37	122.66	Industrial Use	3
1.49	77.36	Administrative use	4
2.95	152.87	Educational use	5
1.29	66.65	Health use	6
0.35	18.34	Religious use	7
9.03	468.21	Transport and communication	8

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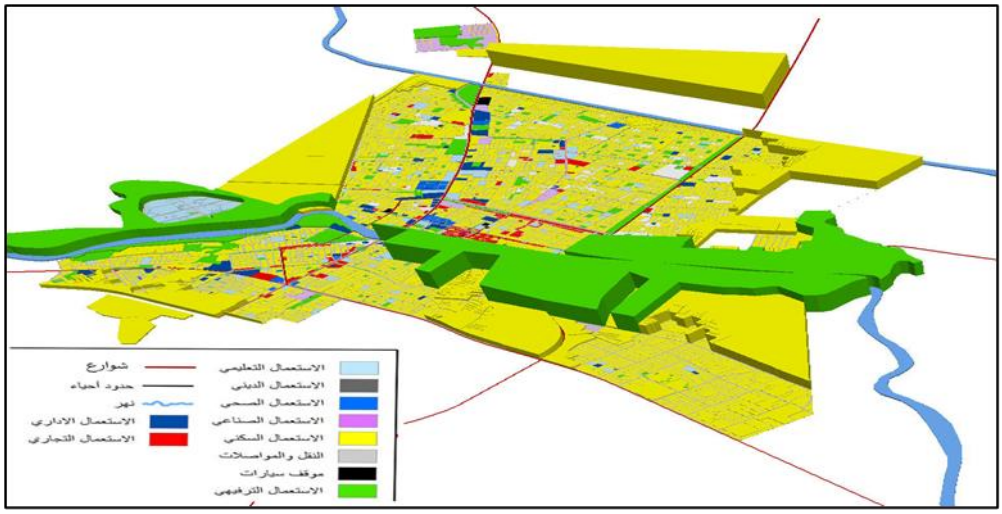
17.48	906.42	Recreational use	**9**
3.94	204.08	Spaces	**10**
100	5184.3	Total	

Source: Accredited researcher Arc Map 10.8.2

Ministry of Planning, Central Statistical Agency, Dhu Qar Census Directorate, unpublished data

Map (8) Trilateral Land Uses Map for Phase VI (2013-2023)



Source: Researcher's work based on Arc Scene 10.8.2

Conclusions and Recommendations

- The city of Nasiriyah has gone through six stages of land use in Morphological City, varying in its area and proportions depending on the expansion of the city's area at each stage of its development.
- The use of three-dimensional maps in morphological analysis of the city of Nasiriyah contributes to a deeper understanding of the terrain, natural formations and general structure of the city, which may contribute to the identification of the city's evolution.
- Geographical techniques, which include sophisticated programming, provide a means of visualizing spatial linkages between the many land uses that make up the study area.
- The study recommends the follow-up, implementation and enactment of laws to preserve Nasiriyah's civilized heritage from ancient cities.
- The study recommends the use of three-dimensional mapping programs and tools that decision makers and planners can use in the formulation of urban controls, as well as giving weights to every urban use, which helps to identify trends in spatial expansion and future urban growth of the city by the competent authorities represented in the municipality of Nasiriyah and the Department of Urban Planning. Because these modern geographical technologies have proven their efficiency in determining the best and most appropriate direction for the spatial expansion of the city

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