Journal of History, Art and Archaeology

Vol. 3, No. 1, 2023, pp. 69-84

URL: www.arfjournals.com
https://doi.org/10.47509/JHAA.2023.v03i01.09

PROTOTYPE OF GRID IN URBAN HISTORY OF SINDH, PAKISTAN

JAVARIA SHAIKH
Professor, Faculty of Architecture and Civil Engineering, Aror University Sukkur

Abstract: *The use of urban grid has a long history of evolution and the precision of urban grid used today is not a coincidental occurrence but an overlap of several transformations over centuries. There are several factors which shaped today's modern grid. Grid has historical and spatial dimensions, varying from micro level anthropomorphic need of forward, backward and left, right human instinctive navigational system to a macro level of urbane need of human nature to move from rural unplanned life style to a more metropolitan planned city which is expandable; this is achieved by employing a universal grid form. The main objective of the present study is to retrogressively trace the origin of the prototypical grid form. It is therefore inferred that the grid originated prior to Hippodamus of Miletus (498- 408 BCE), earlier to Indus Valley (2600–1900 BCE), mature operational grid, and was prior in the presidencies of Çatalhöyük (7500 BCE to 5700 BCE). The line of reasoning followed here is that there is a homogeneous occurrence of the grid pattern ubiquitously throughout the history of cities. Prior to that, four fold variables are applied to analyse the cross-sectional regression model which explains grid system. This in turn associates present grid with three different eras of Mohenjo Daro (Indus Valley Civilization), Mehrgarh (Baluchistan) and Seven Set of Caves (Sehwan 10,000 BCE). The limitation of the investigation is the innate difficulty of the agreement and the pursuit for the derivation of the grids.*

Conclusively five - P factors were characterised as the key motivation behind grid patterns. These are: People, Place, Power, Politics and Product-ability. Thus a grid urban pattern comes into being when: first of all, the power of people are united to build an urban modern city; secondly there is a place available; thirdly, technology and willingness to have a expendable navigational plan, allowing ease to move, permitting security along with infrastructure of drainage and transportation. These five P criteria fit not only the situation as late as Greek planning but is also traceable in the Indus Civilization extending up to Mehrgarh and even way back to cave dwellings where the modern grid could be found.

Received : 16 April 2023
Revised : 13 May 2023
Accepted : 20 May 2023
Published : 30 June 2023

TO CITE THIS ARTICLE:

Shaikh, J. (2023). Prototype of Grid in Urban History of Sindh, Pakistan. *Journal of History, Art and Archaeology,* 3: 1, pp. 69-84. *https://doi.org/10.47509/JHAA.2023.v03i01.09*

Introduction

The grid system in urban planning has a long history, with Miletus being one of the earliest examples of a city designed on a grid by Hippodamus in 479 BCE. This grid layout was subsequently adopted in cities like Piraeus in Athens and Thurii, as well as Rhodes. While Hippodamus is often credited with the development of the grid plan, its origins can be traced back even further.

The grid pattern predates Hippodamus and extends beyond famous civilizations like the Indus River Valley, Mesopotamia, Assyria, and Egypt. It can be observed in Neolithic sites such as Çatalhöyük and Mehrgarh. This study aims to trace the prototype and origin of the grid pattern in settlements and proposes that it can be found as early as the cave dwellings associated with the Indus Civilization.

It is important to note that the Western urban planning tradition, including the orthogonal Greek cities, was standardized and designed prior to Hippodamus. The grid pattern has experienced multiple revivals throughout history, but its historical complexities have led modernists to reinterpret and reclaim its significance. The grids of New Urbanism, for example, differ from the grids of Le Corbusier or Spanish, Roman, and Greek cities. Similarly, Chinese, Korean, and Japanese grids have their distinct characteristics, as do the grids of Mohenjo Daro and Harrapan. Egyptian and Mesopotamian grids also have their unique features. Consequently, historians caution against the use of grids due to their inherent rigidity.

By examining the historical development and variations of grid patterns, this study aims to shed light on the diverse origins and interpretations of this urban planning element.

Early human civilization witnessed advancements in various fields, including urban planning, tool development, and agriculture. It is likely that contemporaneous civilizations emerged in different regions, such as Sindh, which can be traced back to deeper layers of Mohenjo Daro and other sites. However, the exploration of these ancient civilizations is hindered by water-logging issues.

Similarly, in China, a parallel civilization developed along the Hwang Ho River. Traditional neighbourhoods in China were structured based on a highly hierarchical zoning system. This hierarchy ranged from large avenues (*da jie*) to smaller streets (*xiaojie*), local streets (*xiang*), and finally small alleys (*hutong*) (Gao, 2003; Sheng, 2005).

Studying the sequential axial grid plan of a town, along with relevant chronological evidence, has the potential to unveil the evolution of axial grid settlements in town planning. This can be achieved by analysing the apparent external expansion and internal transformations over generations, considering the three key elements of street arrangement, plot configuration, and building coverage. By investigating these aspects, a better understanding of the growth and development of axial grid settlements in town planning can be obtained. This research thus contributes to unravelling the historical significance and evolution of urban planning practices in different regions.

Archaeological evidence suggests that early hunters and gatherers in the region selected specific locations along the banks of mountains and plains for cultivation and domestication of crops and animals. This marked the emergence of the first urban planning in the form of a compact city model, which is the focus of this paper.

During the period from 30,000 to 10,000 BCE, nomadic groups from the western regions of the Baluchistan Plateau likely began to migrate towards the Indus Plain. This movement may have involved a certain degree of racial mixing as these groups roamed across different regions in search of diverse food sources. These groups possessed improved tools and technology, and there was a willingness to settle in close proximity to other groups. They utilised soft hammers to produce sharp-edged blades and scraps, which supported their livelihood as hunters and gatherers.

Around 10,000 BCE, a significant transition towards a settled way of life occurred in the

region. The reliance on wild plants and animals gradually shifted towards organized farming in the river valleys of the hilly regions in north western Baluchistan and the plains. This shift marked a crucial development in the early stages of settled agricultural communities.

There is a significant gap in the examination of how the grid functioned in relation to topographical constraints, starting from its usage at Devils Mouth (*Rakasjo Rohro*) and Seven Small Caves (*Sath Ghari*). Cave dwellings represent a contrasting typology, providing enclosed spaces for protection against wild animals and offering various spacious areas for different classes or communal gatherings.

While the typology and topology of street perception differ between Mohenjo Daro, the cave dwellings, and other settlements, the overall morphology remains similar. The relationship between positive and negative elements in shaping the morphology is distinct. For instance, the brick constructions at Mohenjo Daro and mud structures at Mehrgarh involve additive approaches on flat terrain. On the other hand, cave dwellings exemplify a subtractive mould, where hill topography is carved out to create a grid layout. Early humans employed both additive and subtractive methods to alter nature and reshape the geography for constructing settlements.

In the case of the Seven Caves settlement, a hill was carved and reshaped, displacing nature. Meanwhile, the Lusbella caves demonstrate a combination of subtractive and additive morphological composition. The cliff spaces were carved out according to the grid plan, while the exterior walls and hills were shaped using adobe. This took place around 7000 BCE, when humans had the confidence and skills to migrate to the plains and construct settlements in flatter areas. Mehrgarh, a highly sophisticated city planned on a grid pattern, utilised mud construction in the plain region. In Mohenjo Daro, clay bricks were used, making brick a pivotal element motivating the orthogonal grid.

Thus these early settlements demonstrate the displacement of nature and the use of different materials and construction techniques, which played a role in shaping their grid-based urban forms. In order to enrich the argument, this study aims to incorporate theoretical perspectives on what Welbank has referred to as "The Search for a Sustainable Urban Form." The central focus of the research revolves around the urban history of the grid, exploring its evolution from the pre-pottery period to modern times, which remains a significant topic in the field of urban morphology and criticism.

The understanding of a modern city is not restricted to Childe's categorisation of writing, politics, and trade. It also includes hierarchical urban definitions that extend to the pre-pottery cave settlements in ancient Sindh. In this context, the study draws upon the modern urban concepts put forth by Jane Jacobs, Edward Glaeser, and Wheatley's comparisons of institutional change and socio-political restructuring within societies, considering their applicability to the primitive urban planning in order to draw meaningful conclusions.

By applying these theoretical frameworks, the study seeks to shed light on the applicability of contemporary urban concepts to the ancient grid planning and its relevance to the development of civilizations. This approach allows for a comprehensive exploration of the historical trajectory of the grid and its role in shaping sustainable urban forms over time.

The motivation for human migration from rural to urban areas is not primarily driven by severe weather conditions. Contrasting examples such as the curvilinear and organic igloo habitats or the relatively unplanned and organic nature of semi-nomadic clusters demonstrate that climate is not the main factor influencing the choice of settlement. When primitive societies decided to establish a new town, they sought locations with moderate climates, and they chose to adopt a grid pattern to showcase their power and productivity. All these factors, when examined in the context of primitive cave dwellings, qualify them as urban and planned settlements. This investigation further

expands by presenting evidence for the existence of grid patterns dating back to prehistoric times.

The literature review reveals a gap in temporal models, as pointed out by Stanslawski (1994: 105-120), which traces the grid plan up to Mohenjo Daro (2500 BCE). However, the analysis of Mehrgarh (7000 BCE) to trace the urbanization of the Indus region does not consider prototypes that predate Mehrgarh. Therefore, our research aims to fill this gap by providing evidence for the presence of grid patterns in prehistoric times (Gangal *et al*: 2010: 807-852). By doing so, we contribute to a more comprehensive understanding of the historical development and continuity of grid patterns throughout human civilization.

Literature Review

The literature review of orthogonal lattice focuses on the synthesis of four distinct variables that characterise the arrangement of urban grids. These variables include the alignment and distribution of spaces based on public and private functions, as well as the concentration of mixed uses that overlap in a semi-lattice pattern rather than a disjointed tree diagram (Alexander: 1966). Another important aspect is the circulation of people within the grid, including how the axial layout facilitates movement and visual connections between different parts of the city. The geometrical mechanisms, such as straight lines and right angles, support growth, change, and efficient security by providing clear sightlines and surveillance opportunities (Jacobs: 1961). Density is also a crucial determinant, encompassing both the fringe belt and the process of urban expansion described in Cozenian theory (Lang: 2004). Moreover, the evolution of human settlements is reflected in the consistent application of these principles in spatial-temporal contexts, ensuring a coherent and progressive approach to urban planning.

In contemporary times, the grid pattern has become a prominent and common feature in many American cities, reflecting the natural shape of urban layouts. The grid pattern's dominance in city design can be traced back to the implementation of new city planning by Alexander throughout his empire. However, the use of the grid iron pattern in Greek cities emerged earlier, between 480 BCE and 336 BCE. The Indus Valley civilization also had three major cities, namely Harappa, Mohenjo Daro, and Dholavira, where a distinct commercial boulevard and small residential alleyways were present, reminiscent of the layout seen in the present-day state of New York. The significance of straight lines, served as the foundational algorithm for grid formation where the orthogonal grid pattern is depicted. This raises the question posed by Kostof (2009) regarding the originator of the grid or the right angle, which is at the core of the grid's popularity.

In the quest for the fundamental grid plan, Rose-Redwood (2008: 42-52) built upon Stanislawski's exploration (Stanislawski: 1946: 105-120) with an adjusted approach. Stanislawski had initially presumed that further archaeological discoveries would eventually guide his study of the grid to an earlier historical period. This archaeological evidence was eventually unearthed by a French team of archaeologists led by Jean-François Jarrige during the excavation of Mehrgarh, which corroborated Stanislawski's prediction of evidence for grid planning (Stanislawski: 1946: 105-120). The excavations at Mehrgarh, conducted continuously between 1974 and 1986, revealed the existence of grid morphologies in earlier periods as well. Caniggia's theory proposes that human history follows a similar trajectory to natural history, encompassing processes of birth, growth, prime of life, and death.

Bafna and Steadman provided an explanation for the prevalence of rectangular and orthogonal built forms based on a survey conducted by American architect Albert Farwell Bemis in 1930. The survey analysed 217 apartments and houses in Boston, revealing that a significant majority (83%) of the solid blocks had a rectangular shape. Another influential study by M. J. T. Krüger in the 1970s focused on the urban morphology of Reading city in Berkshire. Krüger's survey map demonstrated that the city had a predominantly

rectangular geometrical morphology, with up to 98% of the built forms based on a grid pattern.

Fox (2000) proposed that the human mind naturally navigates distances using two-dimensional plans and linear strategies. When obtaining directions from point A to point B, and subsequently from point B to point C, a grid shape is intuitively formed. The grid layout incorporates the dimensions of North, South, East, and West, aligning with the movement of the sun, wind, and water, as described by Vitruvius in *De Architecture* (first century BCE). This alignment, along with the orientation of cities to natural directions, aids in making the urban grid legible and enhances the inhabitants' sense of structure and time. Lynch (1984) emphasised the importance of streets as ventilation corridors that facilitate airflow within the city.

Archaeologists and historians often encourage urban planners to carefully consider the design of the grid iron layout. Once the grid is established in urban development, it becomes challenging to revise or modify (Possehl: 2003: 1–20). Similarly, Grant suggested that contemporary planners have come to appreciate the mixed-use benefits of the old town grid over the winding organic streets of the suburbs. He characterized the grid as being opposed to closure and hierarchy while being seen as an antagonist to locus and place.

Dan Stanislawski raises valid concerns regarding the limitations of the axial grid plan. He highlights that the grid system imposes restrictions on the placement and orientation of important structures such as temples, houses, libraries, and workshops. This lack of flexibility in positioning these buildings according to desired factors like sun exposure, air circulation, and privacy can be seen as a disadvantage.

Additionally, Stanislawski criticizes the grid plan for its disregard of the natural topography of mountains, valleys, and hills. The rigid grid layout does not accommodate the inherent features of the landscape, potentially resulting in a lack of integration between the built environment and the surrounding topography.

Teresa Stoppani (2008) questions the validity of the axial grid and its definition in light of Stanislawski's concerns. She raises the important question of whether a grid can still be considered a grid if it allows for external variables and incorporates changes. This challenges the traditional notion of the grid as a fixed and unyielding system.

In response to these issues, the present paper provides a case study of a primitive city plan that was designed on a grid system while respecting the natural topography. This case study aims to demonstrate that it is possible to incorporate the advantages of the grid plan while also considering and adapting to the specific characteristics of the landscape.

Grant (2001) puts forward the argument that different civilizations and cities have used the grid pattern with varying approaches to authority. In the case of Mohenjo Daro, Harappa, New York, and contemporary Utopian cities, the grid was used as a diffused authority. This means that the placement of key areas such as religious sites, recreational facilities, and public buildings was done without emphasizing hierarchy. These cities catered to an elaborate middle-class society and provided amenities such as baths, wells, granaries, and workshops. Mohenjo Daro, in particular, showcased axial grids of narrow paths that served as a protective measure against flooding that in turn, resulted in higher living standards.

On the other hand, civilizations like Egypt, Babylon, Alexandria, and China used the grid as a centralized authority. In these cities, the grid pattern was employed to establish a centralised power structure. The Greek, Roman, and Japanese cities, however, utilised the grid to promote globalising authorities. These civilizations employed the grid as a means of facilitating trade, communication, and expansion.

Edward Glaeser's book *Triumph of the City* emphasises the importance of cities in providing access to food and cultural activities like drama. This further underscores the significance of urban

environments in facilitating human interaction, exchange, and development.

It is noteworthy that the tools used during this Stone Age settlement included hand axes, cleaver core tools, chopping tools, and flakes. These tools may represent middle Stone Age tools rather than early Stone Age tools. Ultimately, the growth and success of a city lie in its people, as Shakespeare aptly expressed with the phrase "what is the city but the people." The magnetism of urban proximity is a driving force behind urban development, and cities flourish when they are able to effectively bring people together.

Rose-Redwood (2008: 42-58) proposed that the grid pattern has reappeared accidentally in various instances throughout history. He also mentions that some historians speculate that the grid arrangement was transmitted from Mohenjo Daro to Greece through anonymous travellers. In contrast, Stanislawski's arbitrary quest suggests a diffused origin for the grid pattern. Rose-Redwood further argues that the grid serves as an instrument for the commoditisation of space, facilitating a liberal legal regime by creating boundaries and enabling the creation of a market for selling parcels of land.

In this study, Childe's theory of urban revolution is applied to the town planning of Mohenjo Daro and Mehrgarh. The theory recognises four chronological eras that have shaped human life: hunting-gathering, agricultural revolution, pre-industrial revolution, and industrial revolution. The agricultural revolution, which occurred around 7,000 years BCE, was the revolutionary period that led to the development of agriculture.

According to Michael Smith (2007: 3-47), ancient cities exhibit a common sense notion of urban grid morphology. Spiro Kostof (1993) also describes the orthogonal planning of the ancient city of Jericho in the Middle East, which dates back to 8000-6000 BCE, as a grid layout. This coincides with the time period of Mehrgarh.

It is worth noting that these statements reflect the perspectives and interpretations of the mentioned scholars regarding ancient city planning and grid layouts.

Methodology

To justify the transition from the Late Stone Age to the urban planning of Mohenjo Daro in Sindh, first, we will examine the theoretical backgrounds in a linear fashion. The grid theory will be applied to all three eras, whereas at Mohenjo Daro, the grid was used with the Indus River serving as a fixed line for the development of a mature agricultural city. In the case of Mehrgarh, the Bolan River acted as the urban fixation line for a semi-agricultural and semi-hunter-gatherer city. As for Seven Caves, which represents a hunter-gatherer settlement, the wind-eroded central spine through the horizontal core of the hill serves as the fixation line. This approach aims to analyse the application and development of grid planning in different historical periods and urban contexts, highlighting the role of natural features such as rivers and topography as fixation lines for urban settlement patterns.

The argument presented by Gangal *et al.* (2010: 846 -852) fills the theoretical gap in the spatio-temporal models by providing a model for agricultural society at Mehrgarh that preceded nomadic hunter-gatherer settlements in caves. This paper also bridges the gap in the investigation of the grid form, which was previously explored by Stanslawski (1994: 105-120) up to Mohenjo Daro (2500 BCE). The research expands upon the original prototype by suggesting the existence of urban morphologies earlier than Mohenjo Daro and Harappa. The paper presents case studies and evidence of grid-planned cave morphologies spanning up to ten thousand years. Field surveys have been conducted to infer urban grid patterns in three cities in the vicinity of Pakistan during the Late Palaeolithic era. This study contributes to a better understanding of the development and evolution of grid planning in prehistoric settlements.

At a micro level, the phenomenon of the grid is driven by the innate ergonomic constraints of

human anthropology, particularly the need for direction-finding using concepts of right, left, forward, and backward. This understanding, which has been recognised for centuries, applies to map reading and route planning, where the grid serves as a tool for axial movement and eye connectivity in design. The grid provides simplicity and enables understanding of a place, making it easier to communicate and navigate. Its timeless and universal nature also facilitates the rental, occupation, and proper demarcation of premises.

According to Fox (2000: 9-19,), the grid can be seen as a way to convert terrain into territory, shaping our brain's perception of geography. The geometric patterns of the grid are manmade, designed to align with our cognitive abilities. Our brains are naturally inclined to imagine straight lines and create mental maps when we explore new places. We rely on our vision to measure distances and orient ourselves in relation to the surrounding environment. Given these inherent tendencies, it is not surprising that humans have been using the grid system since the early stages of human settlement.

At a macro level, expandability is a key motivation for grid planning. When compared to other town layouts, such as the circular plan of Baghdad during the reign of al-Mansur in the eighth century, the grid offers more flexibility for expansion. Circular plans tend to limit the spread and result in unequal plot sizes, as spaces are wrapped around a central *bazaar* (market) area. In contrast, the grid provides equal-sized plots and allows for more efficient land utilisation and future growth.

The choice of brick as a construction material also contributes to the demand for grid planning. Bricks are rectangular in shape, making them compatible with the orthogonal nature of the grid. The standardized dimensions of bricks lend themselves well to the creation of straight lines and right angles, which are characteristic of grid patterns. The use of bricks in construction further reinforces the practicality and feasibility of implementing grid layouts.

Additionally, other constructional constraints, such as the availability of building materials, infrastructure requirements, and urban design principles, can also favour the adoption of grid planning. The grid provides a structured framework that facilitates efficient infrastructure development, land allocation, and the organisation of public spaces. It allows for ease of navigation, orientation, and the establishment of clear boundaries.

Overall, the expandability, practicality, and compatibility with constructional constraints make the grid an attractive choice for urban planning, enabling cities to accommodate growth and development over time.

The sequential history of compact city plans in ancient cities of Pakistan reveals the association of urban grid prototypes with a mix of land uses. The grid layout served as a mechanism for generating contact among people by ensuring that typical origin-destination trips would take pedestrians past several outward-facing buildings. This concept, explained by Hillier in 1999, highlights how the grid facilitates social interaction and connectivity within a town.

By studying the consecutive axial grid plans of a town and considering other chronological suggestions, it is possible to understand the expansion of axial grid settlements in terms of external expansion and internal transformation over generations. This analysis can be achieved by examining the three key elements of street arrangement, plot configuration, and building coverage within the given plans. This enables researchers to gain insights into how the urban grid evolved and adapted over time, both in terms of its physical expansion and its internal functional changes.

The work of Conzen and Conzen in 2004 emphasises the importance of studying the historical development of town planning through the lens of street arrangement, plot configuration, and building coverage. These elements provide valuable information about the growth and transformation of urban spaces and can shed light

on the evolution of urban grids in ancient cities. By analysing the sequential history of compact city plans and studying the interplay between street layout, plot design, and building coverage, researchers can gain a deeper understanding of how these cities evolved and how the axial grid plan shaped their development over time.

Analysis of Case Study Sites

In the study of the evolution of grid morphology in the history of urban planning in Pakistan, several case study sites can be analysed (Fig.9.1). These sites provide evidence of the early use of grid planning, dating back thousands of years and are discussed below.

Mohenjo Daro is one of the most well-known sites of the ancient Indus Valley Civilization. It flourished around 2500 BCE and exhibits a remarkable grid-like layout. The city was divided into blocks, with streets laid out in a precise grid pattern. The layout included residential areas, public buildings, and a sophisticated water management system. The study of Mohenjo Daro can provide insights into the early use of grid planning in urban settlements.

Mehrgarh is another significant archaeological site in Pakistan, dating back to around 7000 BCE. It is considered one of the earliest known farming settlements in South Asia. While the grid layout may not be as evident as in later urban centres, the site shows signs of planned organization and the development of agricultural techniques. Analysing the site can contribute to understanding the transition from nomadic hunter-gatherer societies to settled agricultural communities and the early stages of urban planning.

Harappa is another prominent city of the Indus Valley Civilization, located in present-day Punjab province of Pakistan. It flourished around 2600-1900 BCE and featured a well-structured grid-like plan. The city was divided into different sectors, with streets and lanes forming a grid pattern. The site provides valuable evidence of the use of grid planning in the urbanization process of ancient Pakistan.

Taxila is another ancient city in the same province, known for its historical and archaeological significance. It dates back to the Gandhara period, which spanned from the sixth century BCE to the fifth century CE. While

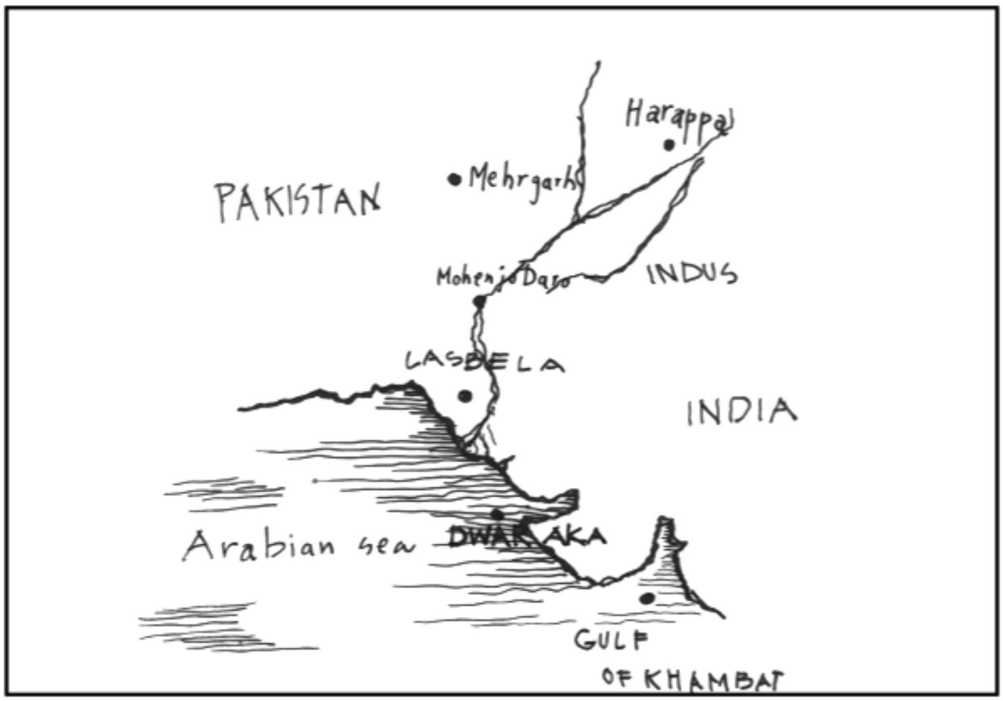

Fig. 9.1. Location of case study sites

the layout of the city does not strictly adhere to a grid pattern, it exhibits planned features, including well-defined streets and organized areas for different functions such as residential, commercial, and religious purposes. The study of Taxila can contribute to understanding the evolution of urban planning in the region.

An analysis of these case study sites and the examination of their urban layouts and planning features provide insights into the early use and evolution of grid morphology in the history of urban planning in Pakistan.

The main argument presented in this case study is the prevalence of the grid pattern throughout the history of cities. The study applies four variables to analyze a cross-sectional regression model, which examines the grid system in relation to three different eras of Mohenjo Daro, Mehrgarh, and Seven Caves at Kai.

A city's grid system plays a crucial role in defining its spatial and functional characteristics as a whole. Without the grid, a city would lose its concentrated nature, high-quality spatial scale, controlled arrangement of space utilisation, continuity, and precise ordering. These characteristics were effectively realised in well-designed compact cities created by early humans at different points in time.

Case Study One: Mohenjo Daro

The grid pattern found in Mohenjo Daro (Fig. 9.2) did not originate from religious influences like in Egypt and Mesopotamia. Instead, it represented the political and economic regimes of different historical stages. The grid in Mohenjo Daro was associated with diverse cultural interpretations, and its historical-geographical development exhibited a complex inter-connection, as observed in the seven cave (Sath Ghariyon) plan.

It is crucial to recognise that the grid cannot be perceived as a universally identical and ideal form, as it possesses an inherent complexity. It can be either open or closed, previously referred to as outward-orientation (e.g., Seven Caves) with a centrifugal nature, or inward-orientation (e.g., Rakasjo Rohro) with a centripetal nature. Therefore, the grid is not simply a straightforward rectangular geometry, but a meticulously co-ordinated network. However, there exists a spatio-temporal gap between Seven Caves and Mohenjo Daro.

The unifying element or the driving force behind the development of city planning in this context is referred to as the fringe belt. For Mohenjo Daro, the fringe belt is represented by the river Indus, while for the seven caves it is the wind-carved caves which were further excavated by human agency. Fringe-belt development entails the formation or intensification of a mixed and space-consuming land use on the urban fringe during periods of reduced outward residential growth. This process goes through three phases: fixation, expansion, and consolidation.

This highlights the importance of conducting research in historical geography within the field of urban studies, as it serves as a meeting ground for geographers and historians. Understanding the historical context and geographical factors that influenced the development of cities allows for a comprehensive analysis of urban planning and its evolution over time.

Mohenjo Daro, with its perfectly patterned gridiron layout, can be compared to the precision of modern-day cities like New York City. This well-planned gridiron structure accommodated a population of approximately 35,000 inhabitants. Notably, the city incorporated advanced engineering features, such as covered ducts for refrigerating grains and an underground sewage system that maintained a high level of hygiene. The sewage system was independent of the city's drinking water supply, ensuring a separate and efficient waste management system (Higgins: 2009).

The Harappan civilization, which emerged from the Neolithic culture around 7000 BCE, stands as the largest urbanised Bronze Age community. A study conducted by Ganga *et al.* (2010: 846 -852) indicates that the urban patterns of the Harappan civilization were characterised by

Fig. 9.2: Map of Mohenjo Daro

a complex urban plan. Through spatio-temporal analysis, the study reveals the spread of Indus sites over a period of 2000 years. The analysis also highlights the presence of satellite towns as part of the urbanised pattern. Furthermore, the temporal model traces the roots of urbanism back to Mehrgarh in Baluchistan, emphasising the historical continuity and development of urbanisation (Gangal *et al.*: 2010: 846 -852). We also find simple multi-room buildings in the Harappan civilization. The spaces between these rooms served various purposes, including burials and areas for domestication related to food production. The establishment of a village farming community marked the beginning of the Harappan Civilization, laying the foundation for its subsequent growth and development.

Case Study Two: Mehrgarh

The excavation of Mehrgarh, carried out systematically in layers and utilising radiocarbon dating techniques, has provided valuable insights into its historical development. The excavation revealed the accumulation of six and a half meters of aceramic deposits and the presence of eleven architectural phases in the MR-3T area sounding.

Through the studies conducted by L. Costantini and R.H. Meadow, a fascinating transformation in the subsistence economy of Mehrgarh has been uncovered. These studies shed light on the changes that occurred over time, offering a deeper understanding of the economic activities and livelihoods of the ancient inhabitants of Mehrgarh. The archaeological findings from Mehrgarh contribute significantly to our knowledge of the cultural and social aspects of this early settlement and its significance in the broader context of human history.

During the excavation of Mehrgarh, two buildings were uncovered in the northern part of the MR3 area. One of these buildings was only partially exposed and consisted of three rectangular rooms. The second building, as depicted in figure four, measured 8x5 meters and

contained ten rooms. The seven longer rooms were approximately 3x1.5 meters in size, with thin walls composed of a single row of bricks.

The unique characteristics observed at Mehrgarh, such as its size and organisation, differ from the early villages in the surrounding regions of West and Central Asia. It is speculated that these distinctive features may be attributed to the influence of an Upper Palaeolithic pattern of social organization. This pattern potentially involved large seasonal concentrations of population, suggesting a different socio-cultural context for Mehrgarh. Exploring this connection is the focus of this research.

Furthermore, it is evident that the exploitation of natural resources in the region predates the occupation of Mehrgarh. The utilisation of these resources in earlier periods probably played a role in shaping the development and sustenance of the settlement. Understanding the historical context and resource utilization at Mehrgarh provides valuable insights into the early stages of human settlement in this region.

The urban morphology of early human settlements was primarily shaped by their vocational activities prior to the advent of agriculture around 8000 BCE. Early humans engaged in tool-making and trade, which marked a significant turning point in history as they had the means to construct and plan dwelling towns. This period, as highlighted by Possehl (2003: 1-20), showcases the emergence of well-designed towns with calculated orientation and a deep understanding of geometric and ergonomic principles.

The architectural features exemplify the intellectual and precise decision-making behind the urban morphological features of these early cities. The use of 1:2 rectangular proportions for the rooms and the inclusion of a 45-degree angle overlapped shift parallel to the north demonstrate the sophisticated design skills and urban sensibilities of Homo, the early human inhabitants. These proportional and directional choices reflect the intentional planning and

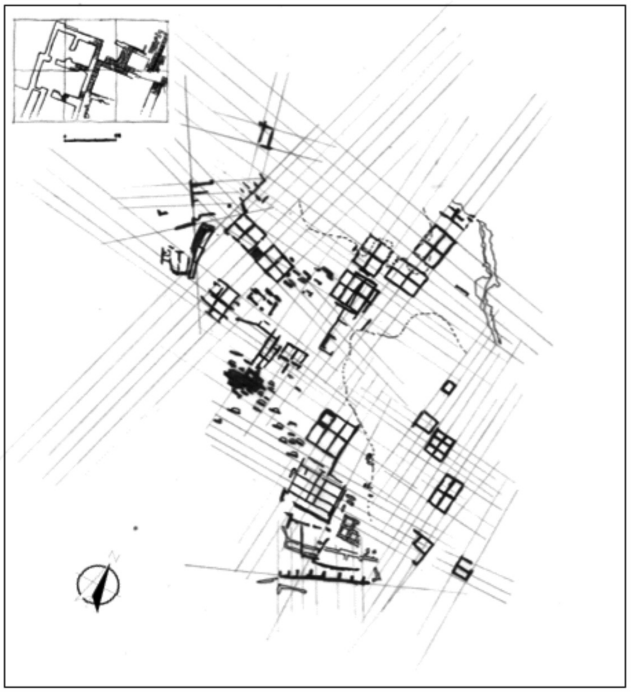

Fig. 9.3: Layout of Mehrgarh re-traced from the field report of 1994-95

thoughtful consideration given to the layout and functionality of these earliest cities.

Early humans, through their tool-making and trading practices, exhibited a remarkable ability to design and shape their urban environments. Their urban morphology highlights their innate understanding of spatial organization, proportions, and the creation of functional living spaces. This early manifestation of urban design by Homo signifies the beginning of a long and intricate journey in human settlement and urban development.

Case Study Three: Sath Ghariyoon (Seven Caves)

The progress of early humans was marked by their evolving nature and the increasing development of their societal and planning techniques. As Snooks (2002: 25-53) suggests, early humans were discovering new materials and expanding their careers, which led to the formalisation of planning techniques. Different considerations influenced the grid formation in early human settlements, indicating the multifaceted factors that shaped their urban environments.

Additionally, as Rousseau (1979:59) emphasises, humans have always learned from one another and have had a natural inclination towards forming close-knit communities. The concept of supplementary neighbourhoods and the need for proximity among humans has been applicable since prehistoric times, as depicted in Figure 9.4. This indicates that even in ancient times, early humans recognised the importance of living in close proximity to one another for social, economic, and cultural reasons.

The progress of early humans, their expanding knowledge and skills, and their understanding of the significance of community and proximity in their settlements demonstrate their continuous development towards becoming more humane and socially organized. These early advances in planning and social cohesion laid the foundation for future urban development and the establishment of more complex and sophisticated societies.

The question posed by Duany (2001: 37) about the value of manmade places in comparison to the natural environment raises an important aspect in the history of urban morphological forms. In the case of Sind, the process of carving out space from the Rohri hills demonstrates the deliberate and strategic planning of the small city to ensure sufficient and comfortable living spaces. This indicates that early inhabitants recognized the importance of creating liveable environments that could rival the value of the natural landscapes they displaced.

Sind, being a region capable of supporting higher population densities compared to other parts of the Indian sub-continent during that time, showcases the adaptability and resourcefulness of its inhabitants. As the population grew, advancements in technology and lifestyle followed suit. It is likely that during this period, early inhabitants of Sind developed crude raft boats and fishing hooks to support their livelihoods. Subsequently, the use of skin floats and nets for fishing may have emerged as further refinements in their fishing practices.

This historical context highlights the ingenuity of early settlers in Sind, their ability to adapt to their environment, and their capacity to create functional and sustainable urban spaces. It is through these progressive developments that urban morphological forms were shaped, reflecting the evolving needs and aspirations of the community.

The transition from constant wanderings to seasonal migration marked a significant shift in the lifestyle of semi-nomadic communities. By spending their winters in the plains and returning to the hills during the summer, these communities

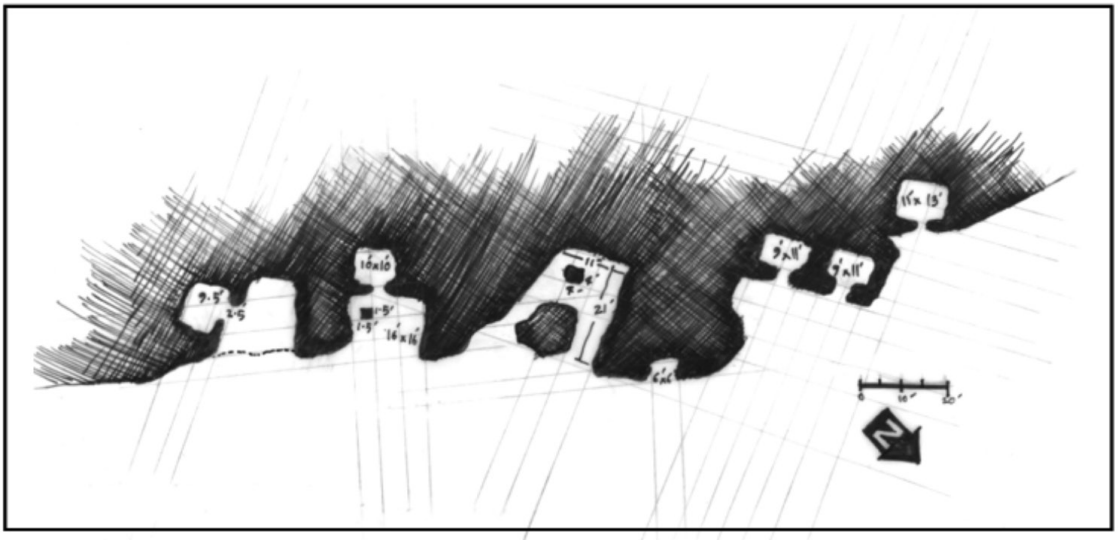

Fig. 9.4: Pal of Seven Caves: the grid is overlapped to shown arrangement

gained valuable knowledge about various aspects of settled life. They learned the fundamentals of crop cultivation, livestock rearing, pottery-making using clay, and constructing houses from mud and reeds. While agriculture was still in its early stages, these semi-nomads continued their hunting and gathering activities to supplement their food resources.

Over time, some of these nomads decided to abandon their seasonal migrations and establish permanent settlements in the fertile Kachchi Plains in Balochistan. This marked the beginning of the first permanent settlement with an orthogonal town plan, characterised by a grid-like pattern. The establishment of a permanent settlement brought about a significant increase in population and social integration. The growth and organisation of the population played a crucial role in shaping the planning of the cave city at Seven Caves, which is believed to be around 10,000 years old. The initial layer of the city in the caves must have been more expansive and densely populated than any previous settlements, showcasing the inherent nature of human proximity and coexistence.

These caves serve as a testament to the natural inclination of humans to live in close-knit communities, fostering social connections and cooperation. The evolution from semi-nomadic life to settled communities paved the way for the development of urban morphology and the establishment of more organized and structured cities in the region.

Conclusion

In conclusion, the 10,000-year-old Stone Age city discovered at Seven Caves represents a remarkable example of early urban planning and architecture. The city's design and layout align with the principles of urban neighbourhood advocated by Jane Jacobs, incorporating elements such as residential areas facing east for optimal views and sunlight. The city's mixed-use neighbourhoods and common front streets fostered a sense of community and provided spaces for residential purposes.

The precision and sophistication of the orthogonal-shaped rooms, organized according to a grid plan with well-defined columns, doors, windows, walls, and stairs, highlight the maturity of architectural features in this ancient city. These architectural elements demonstrate a deliberate and intentional approach to urban planning, indicating a high level of understanding and skill in creating functional and aesthetically pleasing spaces.

Based on these observations, it can be inferred that this ancient city at Seven Caves represents the earliest known example of a city in human history. Its advanced urban planning, architectural design, and consideration for the needs of its inhabitants highlight the remarkable progress and ingenuity of early humans in creating organized and structured urban settlements.

Studying and understanding the urban morphology of such ancient cities not only enriches our knowledge of human history and development but also provides valuable insights into the evolution of urban planning and the innate human desire for community and cohesive living environments. The Seven Caves city stands as a testament to the enduring human instinct to create and shape our surroundings in ways that promote social cohesion, functionality, and a sense of place.

Conclusively, the utilisation of the grid pattern in ancient civilizations such as the Greek grid iron plan, the Indus Civilization, Mehrgarh, and the cave dwelling settlements can be attributed to the interplay of five key factors: People, Place, Power, Politics, and Product-ability. These factors served as motivations for the development of grid-based modern cities.

Firstly, the power of people, their social organisation and ability to collaborate, played a significant role in constructing grid-patterned cities. Secondly, the availability of sufficient land was essential for implementing an expandable and navigable grid city plan. Thirdly, the intentional design of a grid system provided security and facilitated the development of desired infrastructure within the city.

The adherence to the five P criteria in ancient civilizations, including the Greek grid iron plan, Indus Civilization, Mehrgarh, and Cave Dwelling settlements, demonstrates their qualification as modern grid towns. The grid design was not a coincidental development that emerged suddenly in 2500 BCE in the Indus Valley. Instead, it can be traced back to the ancient planning strategies of Sindh, dating back 10,000 years.

In conclusion, the use of urban grids can be observed in the 10,000-year-old cave civilization, and it fulfils all the criteria required to be considered a city. The existence of grid patterns in these ancient civilizations highlights the enduring and universal nature of urban planning principles, demonstrating the human inclination towards creating organized and structured urban environments throughout history.

References

Abro, B. (1998). Marhoo, (translated as The Man:ماڻھو) Jamshoroo: Sindhi Adabi Board. Accessed March 23, 2013 http://www.sindhiadabiboard.org/catalogue/History/Book10/Book_page21.html#نوريوصت

Ahmad Khan, Nabi. (edited) (1989). *Pakistan Archeology*, November 24.The Department of Archeology Paksitan.

Allchin, Bridget (1982). *The Rise of Civilization in India and Pakistan*. Cambridge University Press, p. 53.

Biagi, P. and Cremaschi, M. (1991). 'The Harappan flint quarries of the *RohriHills' Antiquity* 246: 97-102.

Biagi, Paolo (2009). *Archaeological Surveys in Lower Sindh: Preliminary Results of the 2009 Season*

Blowers, Andrew, Hamnett,Chris and Sarre, Philip (edited) (1974). The Future of Cities. The Open University Press, Essex.

Burton, E. (2000). The compact city: Just or just compact? A preliminary analysis.*Urban Studies 37 (11):* 1969-2001.

Burns, Alfred (1976). "Hippodamus and the planned city."Historia: Zeitschrift fur Alte Geschichte: 414-428.

Duany, A. (2000). The rise of sprawl suburban and the decline of nation the American dream New York: North Point Press.

Catherine. J, Jarrige Jean- Francois, Richard. H. Meadow and Gonzague. Q, (1993). 'Neolithic times to the Indus civilization, the reports of eleven seasons of excavation in Kachi District, Baluchistan', by The French Archeological Mission to Pakistan. Page no 331

Childe, V. G. (1950). 'The urban revolution' Town Planning Review Journal 21: 3-17.

Corbusier, L. (1929). The City of Tomorrow and its Planning (New York: Dover Publications).

Conzen, Michael P. & Conzen, M. R. G. (2004). Thinking about Urban Form: Papers on Urban Morphology, 1932-1998 (Lang Publishing, Incorporated Oxford).

Conzen, Michael P (2001). "The study of urban form in the United States". Urban Morphology 5 3-14

Drennan, M. E. (2010). Architecture in archaeology: an examination of domestic space in Bronze Age Mesopotamia.

Fairservis, W. (1971). The Roots of Ancient India (New York: The Macmillan Company).

Fox, William. L. (2000). "The Grid, the City and the Mind". In The Void, the Grid, & the Sign, Traversing the Great Basin. Salt Lake City: University of Utah Press.

Gordon, Peter and Harry W. Richardson (1997). Are Compact Cities a Desirable Planning Goal? In theJournal of American Planning Association, 63, 1: 95-106.

Gates, Charles. (2003). Ancient Cities: The Archaeology of Urban Life in the Ancient Near East and Egypt, Greece, and Rome, New York: Routledge.

Hughes, R. (1995), "Moenjodaro mission report", unpublished document, UNESCO, Paris.

Shaikh, K.H. and Ashfaque, S.M. (1981), Mohenjodaro: A 5000-year-old Legacy, UNESCO, Paris.

HK Hambrick (1996). Sindh Before and After Muslim conquest

H.T. Lambrick (1973). History of Sindh, Before the Muslim Conquest Hyderabad Sindhi Abadi Boards

Hillier, B. (1996). Space is the machine (Cambridge University Press, Cambridge).

Hulsey, J. D (2013). "The Piraeus and the Panathenaia: Changing Customs in Late-Fifth Century Athens." Berkeley Undergraduate Journal of Classics 2, no. 1.

Gangal, K.Vahia, M. Adhikari, R (2010). "Spatio-temporal analysis of the Indus urbanization" *Current Science Academic Journal 98*: 846 -852

Glaeser, Edward. (2011). *Triumph of city how our greatest invention makes us richer, smarter, greener, healthier and happier.* (New York: Penguin).

Grant, Jill (2001). 'The dark side of the grid: power and urban design', *Planning Perspectives 16*: 219-241.

Gnisci, Antonio. (2011). 'Designer Cities, Next Decade' Projects Today:47-49 accessed on May 17, 2013 http://www.projectstoday.com/PTSpecialFeatures/PDFData/PT_KGFT_oct11.pdf

Higgins, B. H. (2009). "Gridiron 2670 BCE." in *The Grid Book* (The MIT Press Cambridge: England).

H.T. Lambrick, (1973). Sindh, History of Sindh, Vol-II, Before the Muslim Conquest, Tilak Incline, Hyderabad, Sindh, Pakistan (second edition 1996).

Hall, Peter. (2002). *Cities of Tomorrow: An Intellectual History of Urban Planning and Design in the Twentieth Century*, Oxford, UK: Blackwell Publishers

Jacobs, J. (1993). *The Death and Life of Great American Cities*. New York: Random House (originally published in 1961).

Jonathan M. Kenoyer (2001). Urban Process in the Indus Tradition: A Preliminary Model from Harappa, , Excavations on two of the major mounds at Harappa have revealed traces of an early settlement, a transitional phase of development, and several phases of full urban and post-urban occupation. A preliminary model is presented for the development of Harappa as a city in the wider context of the Indus Tradition, 2000-http://harappa.drupalgardens.com/category/articles/pdf?page=1

Jansen, M. (1993). *City of wells and drains Mohenjo Daro water splendour 4500 years ago* Stadt der Brunnen und Kand K- Mohenjo Daro, Wasserluxusvor 4500RWTHsbg: Publikationen Germany.

Jarrige, Catherine, Jarrige, Jean- Francois, Meadow, Richard H. and Quivron, Gonzague (edited) *Mehrgarh field report 1994-1985 from Neolithic times to the Indus civilization, the reports of eleven seasons of excavation in Kachi District, Baluchistan*, published by The French Archaeological Mission to Pakistan.

Johnson, Michael. (2001). Environmental impacts of urban sprawl: A survey of the literature and proposed research agenda. *Environment and Planning A 33, 4:* 717-35.

Kostof, Spiro. (1993). *The City Shaped: Urban Patterns and Meanings Through History*. Boston, MA: Bulfinch

Kostof, K. S. (2009). *The City Shaped: Urban Patterns and Meanings Through History* New York : Bulfinch Press, Boston).

Lambrick, H.T. (1996). *Sindh, History of Sindh, vol-II, Before the Muslim Conquest* 1st Edition 1973Tilak Incline, Hyderabad, Sindh, Pakistan.

Lynch, K. (1984). *Good City Form*, London : MIT Press.

Lal, B. B. *A Decade of Prehistoric and Protohistoric Archaeology in India, 1951-1960.* (1963).

Maps have been taken from the further excavation at Mohenjo- Daro Volume II, Plats 1-CXLVI (E.J.H. Mackay, 1937)

Marcus, Joyce and Jeremy Sabloff, eds. (2008). *The Ancient City: New Perspectives on Urbanism in the Old and New World.* Santa Fe, NM: SAR Press.

Marshall. J, (edited) (1931). *Mohenjo- Daro and the Indus Civilization I,* London: A. Probsthain.

Marshall, Sir John (edited) (1931) *Mohenjo Daro and Indus Civilization*, volumes I.II,III republished.

Marshall, John (March 2012) *Mohenjo-Daro and The Indus Civilization*, Volumes I, II & III.(Second Edition).

Morris, A. E. J. (1976). History of Urban Form: Before the Industrial Revolution Prentice Hall (2nd edition)

Masssimo Vidale and Pierluigi Bianchetti, (1999). Identification of Garnet as a possible item of long distance trade from the Indus valley to Mesopotamia in the third Millennium BC, *Ancient Sindh, 1998-1999* 39-43.

Mackay, E. J. H. (1938). *Further Excavations at Mohenjodaro* (New Delhi: Government of India).

M.H. Panwar (2011). *Six Thousand years of History of Irrigation in Sindh on Archeology of Pakistan,* compiled by Prof. RiazSiddiqi, Indus Publications (Reprint,1994)

Marshall, Sir John (1931). *Mohenjo Daro and Indus Civilization,* volume I.II, III republished.

Morris, A. E. J. (1976). History of Urban Form: Before the Industrial Revolution, Prentice Hall (2nd edition).

Morris, A. E. J. (1976). *History of urban form: Before the industrial revolution*, London,UK: Prentice Hall, (3rd Edition).

Micheal Jansen (2010). *City of Wells and Drains, Mohenjo Daro, Water Splendour 4500 Years ago,*

Mohenjo Daro (1973). *Proceedings of International symposium* on Printed at Elite Publishers Limited, D-118. S.I.T.E. Karachi.

Moudon, Anne Vernez.(1997). Urban morphology as an emerging interdisciplinary field. *Urban Morphology, 1, 3:10.* (accessed on Google Scholar)

Pacione, Michael. (2009). *Urban Geography: A Global perspective, London*: Routledge, (3rd edition).

Panhwar, H. (1983). *Chronological dictionary of Sind (From Geological Times to 1539 A.D.)* (Jamshoro: Institute of Sindhology Publication).http://archive.org/stream/ChronologicalDictionaryOfSindh/ChronologicalDictionaryOfSindh_djvu.txt Accessed on December 10, 2012.

Possehl, Gregory L. (1990). 'Revolution in the Urban Revolution: The Emergence of Indus Urbanization' *Annual Review of Anthropology19*: 261-282.

Possehl, Gregory L. (2003). The Indus Civilization: An introduction to environment, subsistence, and cultural history. pp. 1–20 in: Weber, Steven A. and William R. Belcher (eds.), *Indus Ethno-biology: New perspectives from the field.* Lanham MD: Lexington Books).

Paden, Roger (2001). "The Two Professions of Hippodamus of Miletus." *Philosophy & Geography 4, no. 1*: 25-48.

Preliminary Report of the surveys and excavations carried out by members of the "Joint Rohri Hills Report" in January- February 2000.

Prehistoric Baluchistan, (1978). Published on behalf of Indian Society, Jim G. Shaffer, Department of Anthropology Case Western Reserve University Cleveland, Ohio 44106 U.S.A.

Rafi U. Samad (2000). *'Ancient Indus Civilization'*, Published by Royal Book company, BG-5

Rousseau, J. Émile, (1979). Cities are the abyss of the human species. *(Les villessont le gouffre de l'espècehumaine). Book 1,* originally published in France (1762)

Rose-Redwood, R. (2011). "Mythologies of the Grid in the Empire City, 1811-2011"T*he Geographical Review, 101*: 396-413.

Rose-Redwood, R. S. (2008). "Genealogies of the grid:revisiting Stanislawski'ssearchfor the origin of the grid-pattern town" *The geographical review 98:* 42-58

Sonit Bafna, Sudha Shah (2007). 'The evolution of orthogonality in built space: an argument from space syntax' *Proceedings, 6th International Space Syntax Symposium*, İstanbul.

Smith, M. (2009). 'V. Gordon Childe and the urban revolution: A historical perspective on a revolution in urban studies'. *Town Planning Review 80(1),:* 3-29.

Smith, M. (2007). 'Form and meaning in the earliest cities: A new approach to ancient urban planning', *Journal of Planning History 6,1*:3-47.

Smith, Michael. (2010). Sprawl, squatters and sustainable cities. *Cambridge Archaeological Journal 20:2,* 229-253.

Snooks, G. D (2002). 'Uncovering the Laws of Global History', *Social Evolution &History 1*: 25–53.

Soja, E. W. (2000). *Postmetropolis: Critical Studies of Cities and Regions*. (Malden: Blackwell Publishers)

Stanislawski, D. (1946). The Origin and Spread of the Grid-Pattern Town. *Geographical Review 36:*105-120.

Steadman, Philip (2006). Why are most buildings rectangular? theory *Architectural Research Quarterly. Vol. 10 .no 2* . 119-130

Steadman, Philip (2007). Rectilinear Reasoning, is a paper on *Architectural Research quarterly/ Volume 10 / Issue 02 / June 2006,* pp 91-912006 Cambridge University Press DOI: http://dx.doi.org/10.1017/S1359135506000169 (About DOI), Published online: 02 March 2007

Pacione, Michael. (2009). *Urban Geography: A Global Perspective* (3rd edition). London: Routledge.

Welbank, M. (1996). The search for a sustainable urban form. *The compact city: A sustainable urban form,* 74-82.

Wheeler, Mortimer (1953). *The Indus Civilization* The Cambridge History of India, supplementary volume by CIE, Printer in Great Britain, at the University Press, Cambridge

Yadav, N. Vahia, M. N. (2011). "Reconstructing the History of Harappan Civilization" *Journal of Social Evolution and History* accessed April 18, 2013 http://www.socionauki.ru/journal/files/seh/2011_2/087-120.pdf

لاوڻاکڙ Memom Abdul Majeed Sindhi 2001, Mohenjo Daro Publishing Agency

وڙدوجن‌هوم by Jaleel Moryani 2011 Sindh Adbi Academy Karachi.