

Typology of Towers: An Incentive to Tower Ecological Architecture in Saudi Arabian Cities and Wilderness

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Abstract. This paper identifies and classifies typologically the many kinds of towers in Saudi Arabia. It identifies the forces behind their construction, demise, and role as structuring elements in the built environment and wilderness. It also discusses the value of preserving such important structures, especially in regard to built forms, urban spaces, and vernacular landscapes.

Ecological architecture in this context means the adaptability of a tower or a group of towers as organisms or community of organisms to the dynamics of the relationship with the environment. The conceptual relation between ecology and architecture is apparent in the linguistic origin of the term ecology. The basic argument here is that the relationship between culture, nature and the built environment is more of an ecological nature. That is to say, the tower is more than a combination of structural elements which enhance the user's attention and activities. A new understanding of tower design must have a broader ecological view than that of a limited, mechanical interpretation of the relationship of nature and architecture.

The warning and defense towers were developed since long times of political instability characterized by intertribal raiding. The unification of Saudi Arabia in 1932 brought this period to a close and opened the hands of a new typology of towers. While the inception of minarets emerged with the arrival of Islam in the 7th century, other forms of towers like those which were used to ventilate buildings or to guide ships or caravans were developed since a long time. The new typology of towers includes but is not limited to, water towers, telecommunication towers, airport towers, cooling towers etc.

The drastic transformation in the perception of towers occurred as soon as the Saudi society was exposed to several forces of change.

Introduction

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The traditional settlements and landscapes of the Arabian Peninsula are distinguished by a variety of towers. They were erected and maintained for centuries as part of overall systems of ritual, orientation and defense. In a predominantly harsh environment like the Arabian Peninsula, the tower architecture relied on a variety of indigenously developed construction techniques, leading to the development of various distinctive types. Further, classification could arguably be the device which is the basis for the origin and development of building types [1].

Architecture is not just the activity of building. This is certainly true. Because human beings are intellectual organisms, they vividly employ their capacities to produce all kinds of artefacts that convey meaning and imply cultural dimension. It is this very property that credits these artefacts with their aesthetics as well as their functional values. Ecological architecture, whose essence is deeply felt through its adaptability to different geographic locations and cultures, has been recognized as socially supportive rather than destructive [2].

Tower architecture is a medium for investigating its adaptability to culture. An ecological architecture is an acceptable meaning of culture. The culture implies the modes of thought, norms, beliefs, ways of life, the ideologies and the total range of customary habits of a social grouping. All of which have been influenced by people's adaptation to their environment. Therefore, tower forms are like eco-culture, evolved with physical characteristics as vital to evolution as biological diversity. Eco-culture is comprised of differentiated regional cultures based on ecological values and relative self-sufficiency interacting on the basis of mutual compatibility [3]. While ecology implies a significant theme which could indicate major traits that characterize modern practices and theorization within the area of architectural and environmental design studies. As long as the requirements of physical environment and their role are linked and concerned in producing diversified architectural forms, different cultures then imply different ways of life which differentiate the built environments. The differentiation is attributed to human's adaptation to different ecological conditions. Unfortunately, these have been widely swept away under the mythical notion of 'International Style'.

The present study examines the concept of ecology and identifies its variables that are crucial in designing and forming towers. These ecological variables are identified as natural and physical factors. Natural factors are not limited to climate, topography and material whilst physical factors are pertinent to tower typology. The interrelationship between these major factors is cross-examined with regards to different ecosystems of the geographical regions of Saudi Arabia. The climatic factors that act upon the generation of the towers consist of solar radiation, wind, and precipitation. The topographic factors that act upon the allocation of the towers in flat, or sloped, lands influence the domain of

the tower and its visual perception. Finally, the availability of building materials and their influence on building techniques and suitability for building a tower is researched. In addition, towers need to respond to cultural needs as well as the physical environmental factors of climate and topography. These ecological factors influence the ways of integrating the towers with buildings clusters (compact or dispersed) which depend on security and climatic restrictions.

Eco-development requires both appropriate technological and built solutions in order to translate principles into environmental results [3]. Lessons could be derived from the principles of ecology and their relevance to planning and design [4]. Ecological architecture begins with a conception of architecture as culture, and builds upon the evolutionary view of culture and architecture as processes, products and producer of physical and symbolic adaptation [5].

As a holistic paradigm, ecological architecture recognizes the indivisibility and complementarity between physical and cognitive rituals, as well as spiritual aspects of adaptation between architecture and people and between architecture and place. The architecture that satisfies the holistic and evolutionary outlook and purpose is an ecological architecture. The fitness of ecological architecture to the environment enhances adaptability and proper resource use. The ecological architecture brings consciousness to the environment, though, the natural and historical forces have shaped the towers' physical appearances. One can detect the complicated relationship between political organization and the ecological pattern. The change in socio-cultural and political environments are indications of the influence of exotic technologies. This may yield ecological changes and a new pattern of towers and built environment. At one end of the scale of the ecological environment, human beings are indisputably dominant, and nature is brought in only for human's pleasure and to give beauty to their architecture.

Natural processes govern the ecological environment and formulate coherence between the towers as elements of the cityscape and rural landscape. The spirit suggests a sense of inclusion, not just natural elements, but human-made features which embrace the social and psychological atmosphere that shape human response [6].

Towers are aspiring to embody the best of people's designs which express social, aesthetic, political, economic and spiritual values through people who seek new meanings and new forms that express relationships of the society to nature.

It is the purpose of this paper to review briefly the typology of towers and the progressive impact of human beings upon the tower environment. The urban and architectural modification and conflict occur following certain transformation and implications. The fundamental and inescapable forces are behind the architectural features of the tower. The natural ecological features and the geographical isolation of tower groups from each other are incentives to tower ecological architecture.

The ecological architecture of old towers is distinguished by four main types. Towers typology of the past takes the form of road markers, minarets, defense and warning structures, and ventilation wind scopes. The towers in the highlands are distinguished from the towers of desert or coastal areas by virtue of their function and size [7-9].

Research Methodology

The field research conducted from 1990 to 1996 included extensive interviews and notation with users and master builders of several types of towers. Research on the typology of towers is beset by a methodological dilemma; tower archetypes are spontaneous and cannot be included as a whole in a single research. Besides, the investigator cannot capture the ecological characteristics of all towers. The investigator used 'informant surveys' as an appropriate research methodology for the study of tower typology.

The investigator asked respondents about the context, physical attributes and their perception using a standard set of questions in an open ended questionnaire form. The research used technique elicited information relevant to the tower typology and ecological characteristics. The investigator asks the informants about the institutional features of towers. Does the specified tower mean something to them? What type of tower does the informant use? Since people are using more than one tower, and also for aggregate measures, the informants were asked about the role of the most important tower in their life. Finding an appropriate unit of analysis was problematic since user may have had different visual associations with towers.

The investigation attempted to survey best known towers in five regions of the kingdom. Synonyms of towers were given in every region or sub-region of the kingdom through the dependent variables: type, use, construction, transformation and associated meaning are the same. The investigator was able to obtain the primary data from the field and supplement it by the interviews. Certainly, primary data have been studied closely for any irregularities in the tower's physical attributes or ecological characteristics especially when cross referenced regionally.

The research is preliminary in the sense that the variables, selected on the basis of exploratory field work, had no firm root in theory. The only sure way to accumulate knowledge in any field is to work from strong theory. However, such a theory appears not to exist for the problems of tower typology of interest here. It is possible, nonetheless, to outline a set of categories and some directions for measuring variables that offer considerable hope for achieving cumulative progress. The literature in this field implies a frame of reference that is compatible both with general observation and the capabilities of the informant survey technique.

Origins and types

Many ancient and vernacular concepts in architecture remain valid and fitting to an ecological precept [10]. Warning and defense tower were one of the most prominent vernacular buildings forms before the establishment of Saudi Arabia in 1932. In addition to their obvious defensive purpose, in many instances, they were utilized for identifying spaces and areas: physically and symbolically.

In general, the Arabian peninsula witnessed the development of three types of towers. The first evolved due to the need to demarcate vast spaces, such as tribal lands and borders. Its earliest form may have been the *rijjm*, a stone heap used as a semiological instrument by nomads. These heaps, used to relay messages to passers-by. Later, it may have evolved into permanent stone markers known as *amial* (column-like needles) (singular: *mil*), and *a^clam al-tarik* (signs of the road). *A^clam* would eventually become valuable to travelers crossing the barren lands of the Arabian peninsula on pilgrimages to the Muslim holy cities of Makkah and Madinah. A third type of marker, *Shahid*, was used to define confined spaces such as graves or the boundaries of sacred areas, among which were the *Haram* boundaries of Makkah and Madinah. The sacred and ritual spaces ^cArafat Mount and Mina and Muzdalifa.

While *rijjm*, *mil* and *a^clam* gave the Arabian Peninsula built environment and wilderness distinguishable physical attributes, a similar structure in coastal areas, *fanar*, was developed as a navigational aid for sailing ships. Sailors were then able to identify seaports from afar. In antiquity, ships avoided traveling by night. But later, when ship traffic increased, the famous tower presumably also became a lighthouse, with a fire lit on top at night. Thus, *amial* and *fanars* served roughly the same purpose, with one directing travelers at sea, and the other travelers in the wilderness of the Arabian Peninsula.

The second important type of tower served the needs of warning and defense. Governmental patterns in the Arabian peninsula have characteristically been distinguished by political fragmentation, which gave autonomy to every settlement. This condition, combined with an open geographical context, led to the need for a local system of defense. The centerpoint of such a system were towers that could be used both as strong defense points and surveillance platforms. Such towers took a number of forms, and were known regionally and typologically by a number of synonyms: *murgab*, *bitil*, *burj*, *sungar*, *mintar*, *muntaf*, *husn* or *qasabah*.

The architectural character of warning and defense structures established a certain formal sense of approach to the traditional settlements that contrasted with the sense of peace and hospitality which characterised these settlements. Defensive structures were often the first and most notable structures that faced strangers as they approached the traditional settlements. Most settlements in the central region were walled, with a number

of fortified gates (*bawabih*) and towers (*migasir*) located on the settlement wall. Towers could be located on a wall or at strategic points in the surrounding landscape. Some settlements had particularly tall towers, known as *murgab*, for keeping watch over the surrounding countryside.

Settlements in the mountainous southwestern region of Asir were not walled. Since they lacked walls, they relied instead on natural features of the topography to establish a defensive posture [11]. Towers were included within the built form of the settlement as well as in the landscape surrounding it. The villages with these towers took on special importance. Thus, different types of fortified structures called *husun* (singular: *husn*), or *qasabat* (singular: *qasabah*), evolved. These stand-alone towers were strategically distributed in and around the settlement.

The third important type of tower on the Arabian Peninsula developed with the arrival of Islam. Islam produced new forms of towers, called *minars* and *minarets*. Initially, such structures identified sacred and ritual spaces in the communities of early Muslims, and were built adjacent to the prayer hall. Linguistically, the word minaret literally means "sign", and true to their name, they have long been used to broadcast the ritual message, the *athan*, or call for prayer. But beyond this functional purpose, the minaret has also come to symbolize the importance of the mosque and its central role in the community. And, by the end of the pre-state period before the establishment of Saudi Arabia in 1932, minarets had developed a highly symbolic role, sharing a prominent position with *murgab* on the skyline of many traditional settlements.

In terms of form, the minaret is the most important structure in the Muslim history. The case that the minaret was formally the most important is the fact that there are many cross-cultural influences which led to formal variations in the architecture of minarets, whereas the form of the *murgab* seems to be rather standardized, varying only in size and/or detail.

Taxonomy and typology of towers

Geographically, the Arabian Peninsula is divided into five distinct regions (Fig. 1): (1) Najd plateau at the heart of the peninsula, (2) the Hejaz, occupying the lowland between the Red Sea and Najd Plateau, (3) Al-Hasa, spreading over the lowland between the Arabian Gulf and Al-Dahna sand dunes, (4) Asir, covering the high lands in the south western part of the Arabian Peninsula and, (5) Tihamah which is a strip parallel to the highland mountains and the Red Sea. Such geographical taxonomy provides ground for wealthy settlements and regional architecture. Wealthy settlements constituted targets for nomadic raiding [12], and so the importance of warning and defense towers was underscored.

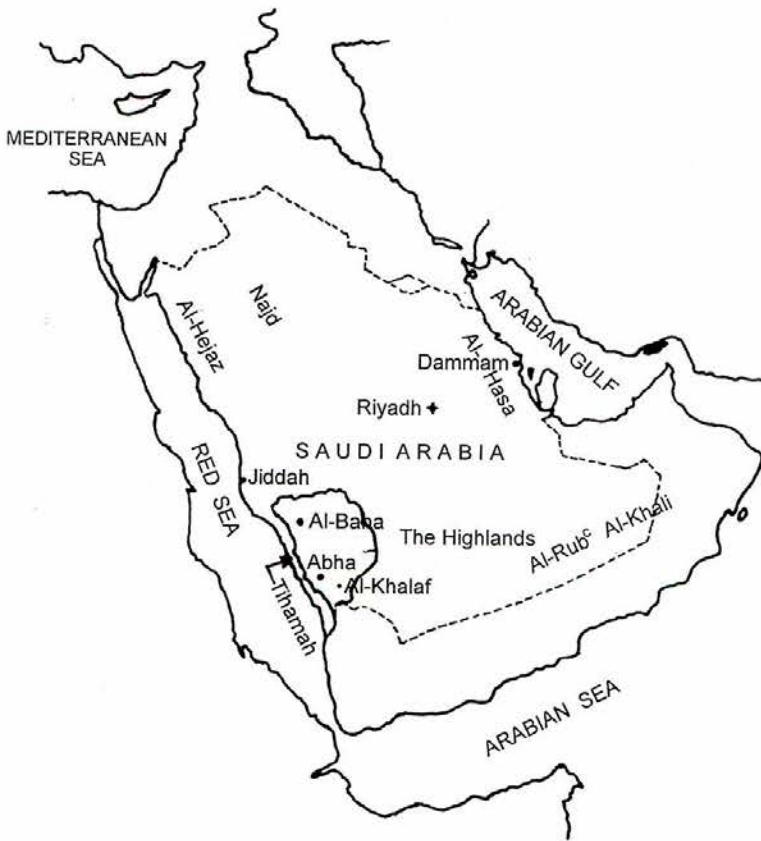


Fig. 1. Map of Saudi Arabia showing the geographically distinctive region. Each region is rich in its traditional towers.

These towers have characteristically distinguished the structure of many settlements (Figs. 2 & 3). The political disintegration which prevailed in the Arabian peninsula gave the regions as well as individual settlements distinct autonomy. This led to the need for a local system of self-defense.

The taxonomy of towers can be based physically on the type of structures or functionally on the form of performance, the way a tower performs, i.e. minarets, wind catchers, lighthouses or warning and defense structures. They represent the most prominent vernacular forms in the pre-state period in Saudi Arabia due to their physical, symbolic and ritual importance. Towers of the past provided an eloquent narration of local architecture, religious, socioeconomic, cultural and political history [13-15]. They were registers of social events and codifications of moral principles and cultural values that made life meaningful in the Arabian settlements and barren landscape.

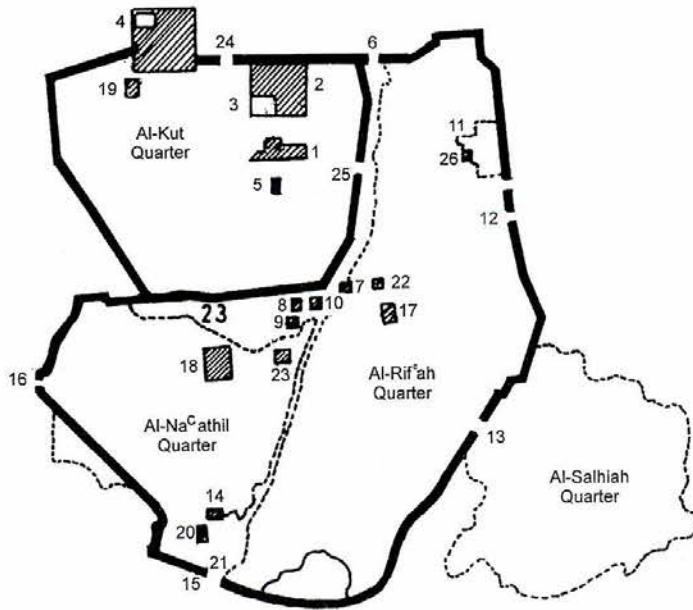


Fig. 2. A schematic site plan of Al-Hasa with its two distinctive sectors. *Al-Kut*; the military fortress and affiliated structures is surrounded by a monolithic walls. The other walled town with its distinctive residential quarters.

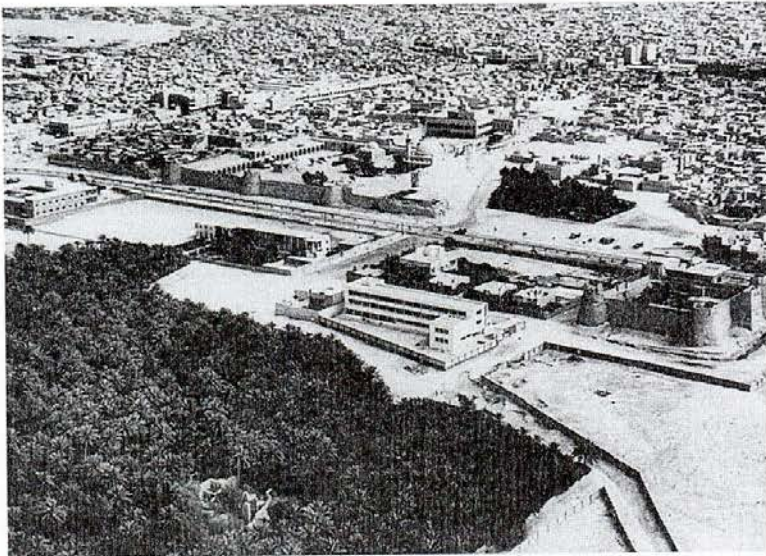


Fig. 3. *Al-Kut* fortress after the demolition of the wall. The fortress is now preserved.

The typology of towers can be attained from the ritual, guidance, defense and surveillance ground. Such towers took a number of forms and names. They were known regionally and typologically by synonyms (Figs. 4 -12): *murgab* (in northern Najd), *bitil* (central Najd), *burj* (in central Najd), *sungar* (^cOnaizah), *mintar* (north-western Hijaz), *muntaf* (southern Najd), *Qal'ah* (western and eastern regions; Madinah and Al-Hasa), *husn* (northern highlands of Asir) and *qasabah* (southern highlands of Asir). These towers varies in heights and size. They reach 30 meter in height and around four meter in diameter or side. They take prismatic and conical forms. They are built from adobe or stone or combined.

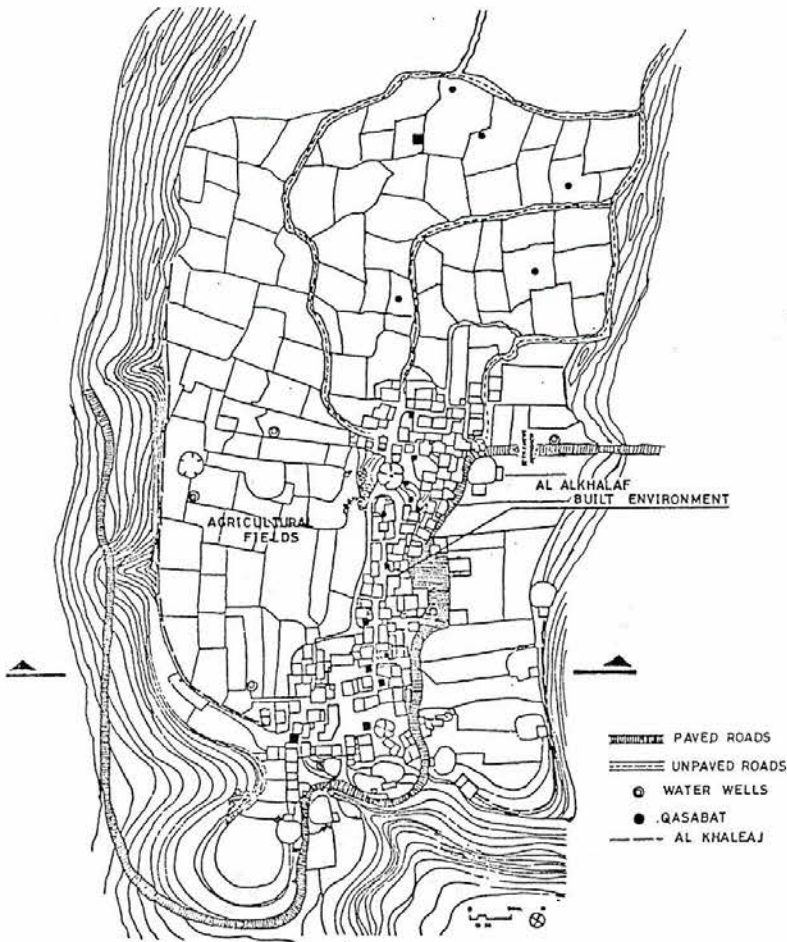


Fig. 4. A schematic site plan of Al-Alkhalaf settlement (southwestern region) shows the distribution of *qasabah*; warning and defense towers inside and outside the settlement.

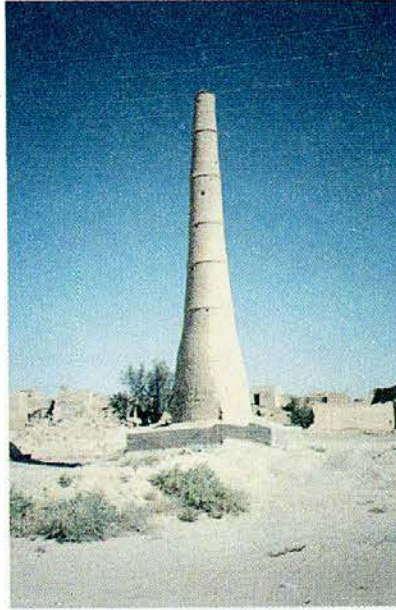


Fig. 5. *Al-Bitiliw, Irghabih* town is a high tower which soars 30m into the sky to show strangers or enemies of the past the power and readiness of inhabitants of any expected attack.

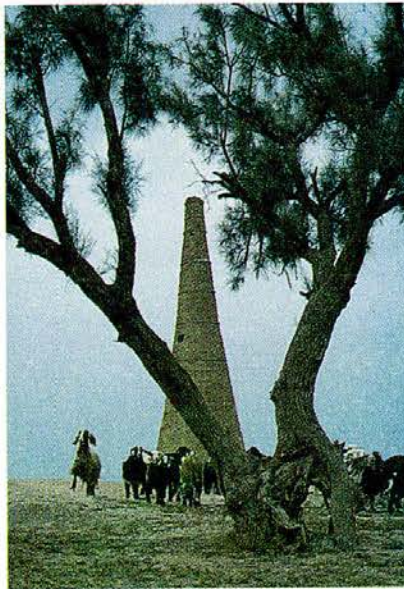


Fig. 6. *Al-Murgab* of *Al-Shinadah* village remained saved after the destruction of *Al-Shinadah* settlement in 1905.



Fig. 7. *Al-Sungar* is a Turkish name for warning and defense tower. ^c*Onaizah* town had two *sungars* which were built of stone and constructed on eastern borders of the town. One *sungar* was demolished but redesigned with the whole cultural center of Saleh Bin Saleh while the ruins of the other one remained waiting for remodeling.

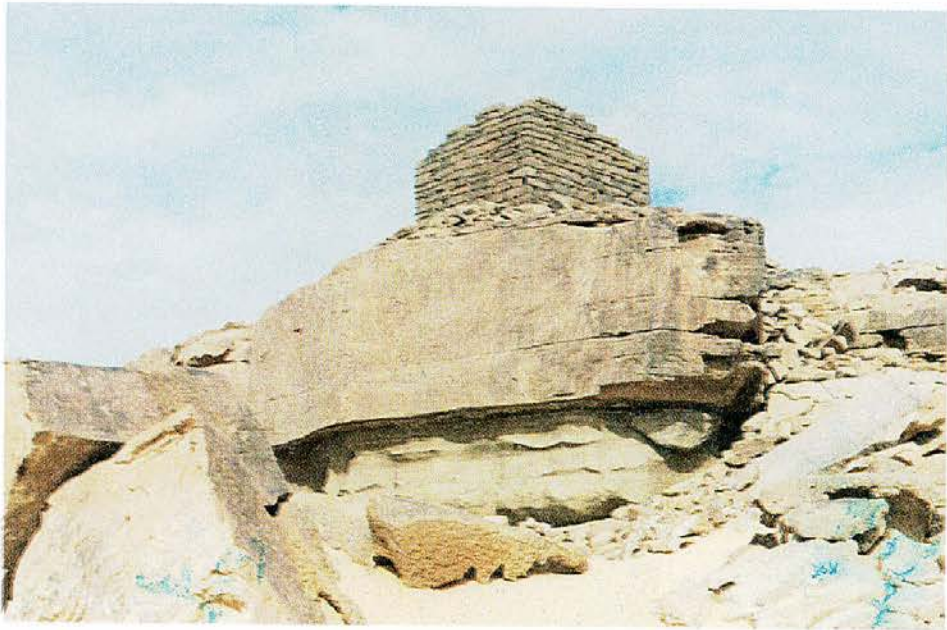


Fig. 8. *Al-Mintar* is a tower on high mountain was used to warn semi-settled people. *Mintar Bani* ^c*Atiah* in norther Hejaz region is still preserving its form since hundreds of years.

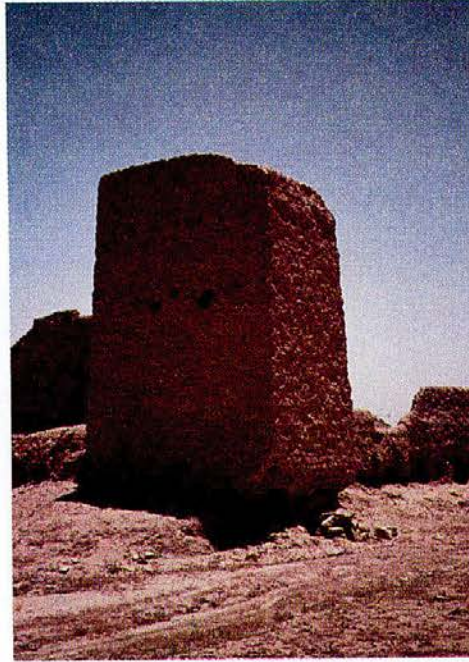


Fig. 9. *Al-Muntaf* is similar to *Al-Batil* or *Al-Murgab* but it is shorter in height. *Al-Hutah* of Bani Tamim in southern central region possesses several ones which need maintenance.

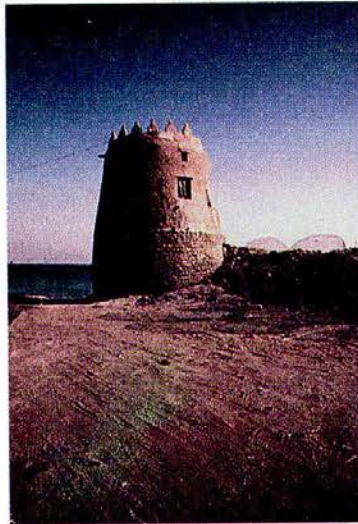


Fig. 10. *Al-Qal'ah* is the name given to the fortress. This name was brought to the Arabian Peninsula by the Turks. Tarut is an island in the Arabian Gulf with a famous *Qal'ah*.

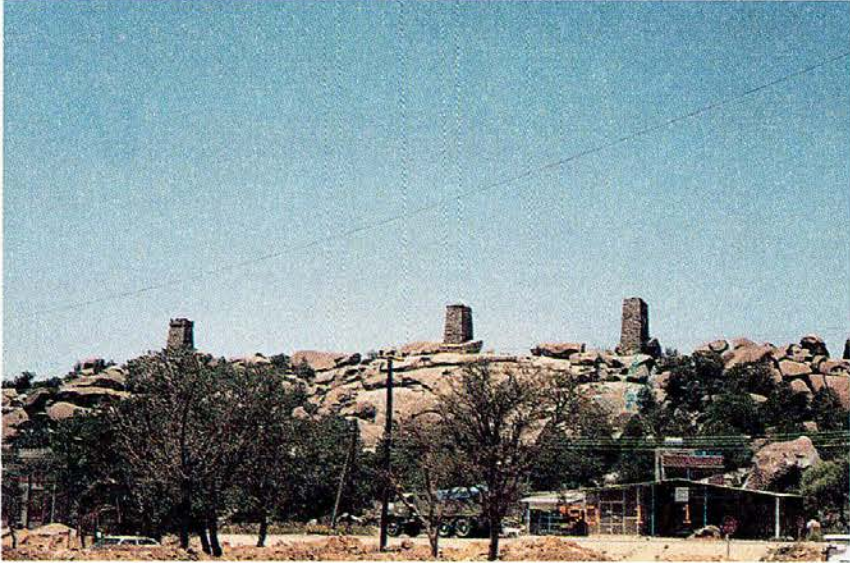


Fig. 11. *Al-Husn* is the name given to the warning and defense tower of the northern part of the southwestern region. *Al-Husn* is mainly built of stone.

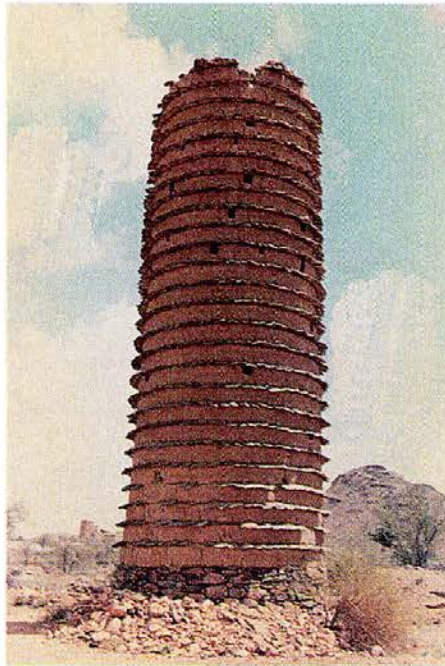


Fig. 12. *Al-Qasabah* is the name given to the warning and defense tower of southern part of the southwestern region. *Al-Qasabah* is built with either adobe or stone or mixed.

The allocation of towers established certain formalities like the approach to the traditional settlements and open spaces. The *husn* or *qasabah* took special and important form in settlement environment either in the landscape surrounding the village or interwoven with the built form. There is a link between the culture and the built form and the form of the physical environment can be supportive or destructive of life styles, value systems and cultures [2].

The minaret is an important type of tower in the Muslim community. It emerged and developed with the arrival of Islam in the seventh century. From a purely geopolitical point of view, the rise of Islam represents the most significant juncture in the history of the Arabian Peninsula [16]. Muslims added new physical forms to their worshipping space and called it *minars*; a synonym of lighthouse or visual image of a barren land. Its function was primarily to propagate the calling for prayer in sprawled neighborhoods as the distance between them was far. Local master builders in every region of the Arabian peninsula, contributed to the creation of original forms to the minarets they built (Figs. 13-16).

The field survey enabled the investigator to classify towers ecologically according to their function, structural system or building materials. A classification of towers according to their forms has not received sufficient attention. This is partly due to the extreme difficulty of such task. The few attempts that have been made to classify buildings according to their form all suffer from serious shortcomings [17]. The survey of towers restricted the typology into three categories. As illustrated, many towers are dominated by common features which result from accepted practices and/or the specific circumstances of the site. It is found that monuments represent part of the historical and cultural heritage of a country though do not offer a direct contribution to the economy [18].



Fig. 13. The skyline of Al-Alkhalaf settlement is distinguished by 14 *qasabah* within the built form of the settlement and 12 *qasabah* in the vicinity of the settlement.



Fig. 14. The minaret as a symbol of Islam calls the intruders of the community for the peace. It contrasts the warning and defense towers which were associated with aggression and fighting.



Fig. 15. The minaret takes circular or rectangular forms which resemble the warning and defense towers.



Fig. 16. The mosques in traditional settlements of the southwestern region lack minarets. When the settlements abandoned the construction of *Husn* or *Qasabah*, they adopted the erection of minarets.

The typology of towers denotes three distinctive grouping. The first grouping includes historic towers such as warning and defense, minarets, lighthouses, and ventilation towers. The second grouping contains symbolic towers such as clocks, logos and emblems, along with airport, new lighthouses, prisons and guard towers. And the third grouping consists of functional such as towers, telecommunication, water and gas, television, electrical, wind, incinerator, cooling and silo towers (Figs. 17-24).

For centuries, the urban structure in and around villages and towns in the Arabian peninsula was characterized by independent entity. Historically, the limited economic resources and unstable political conditions of Arabia, along with tribal traditions of intertribal raiding and revenge, led to strife and insecurity which necessitated the planning design of buildings and spaces to comply with them.



Fig. 17. Most of the contemporary minarets took new forms in terms of shapes and construction materials.



Fig. 18. Telecommunication towers replaced functionally the warning and defense towers but the technology influenced their form and height.



Fig. 19. The domestication of pigeon and doves necessitated the building of towers which serves as a good ventilated and secured space for pigeons.



Fig. 20. The civil life demanded the use of water for domestic life other than just drinking which necessitated its fair distribution among the settled dwellers. This makes the erection of water towers imperative in almost every community.



Fig. 21. Since the near past, TV broadcasting was necessary through high towers. Every city built its own TV tower which might give an image of the city. Riyadh, the capital of Saudi Arabia, built a tower with 170m height which became an emblem of Riyadh.



Fig. 22. A typical view of electrical transmitting lines. Metaphorically, they share other towers in carrying the electrical power.



Fig. 23: The wind tower is associated regionally with the Arabian Gulf region. The building of the Gulf consolidated countries in Riyadh took the tower as an icon for the building.



Fig. 24: The photograph shows four Malqafs (cooling towers) recently built in Al-Nozl (Hotel) in Skaka town in Al-Jouf region north of Saudi Arabia to ventilate closed onopen spaces.

In such social environment, the character of settlements developed partly as a result of the need to form cooperative and protective groups to secure tolerable working conditions and provide reasonable stability. When people build for themselves, they use centuries of experience which crystallizes into built form. These forms demonstrate an understanding of the ecological, social and aesthetic features of the context with which such forms develop [19].

The fact that there are many formal and regional variations in the architecture and urbanism between towns and villages in the same region seemed to be varying only in artistic touches such as colors and building techniques and details.

Such investigation addresses the problem between the meanings that professionals intend for buildings and the meanings that laymen attribute to them. It was decided that the most straightforward and effective way to approach this problem was to conduct an open ended interview in which professionals and laymen would be directly compared in their attribution of meaning to towers. The primary objectives of the interview were (1) to determine if the physical attributes of towers buildings can be considered to constitute a "code" capable of communicating the intention of to the users of such structures. (2) to determine if the areas of disagreement, if any, should be attributed to professional attitudes as long as architects and laymen differ greatly in the underlying dimensions of meaning and (3) to judge new towers' meanings and assess the differences in specific judgments of meaning.

Tower dependent variables

1) Use

The size, height, design, number and location of historic towers in the Arabian peninsula reflected, to an extent, the wealth and importance of each settlement and the political situation in which it found itself. There were also a number of other concerns. For example, tower image construction involved ecological considerations, geometric orientation, ritual and symbolic implication.

Traditionally, the location of warning and defensive towers within settlements of heterogeneous society were in the public domain, while those of homogenous societies like in Asir were located within the property of each kin group living in a settlement. In the latter situation, each residential quarter would generally be protected by at least one *qasabah* or *husn*. The *qasabah* or *husn* structure was the property of the residents of the residential quarter, who shared responsibility for its construction and maintenance.

Defensive towers were generally either circular or square. Square towers were generally interwoven with the built form, while circular ones generally stood on the periphery of the settlement or in the open land or fields around the settlement. The choice of stark geometrical plans shapes for the towers - circles and squares - was primarily a result of the interplay between the materials used and the way they had to be

formed into structures. But, the architectural form also provided the image of great strength, a distinct aesthetic and visual effect.

For example, the settlements in Asir the circular watchtowers were located at places commanding the agricultural fields, with their entrances facing the settlement.

Many of the qualities of the defensive towers set them apart from minarets. For example, minarets have internal stairs that lead to the roof platform, used by *moathen* (caller for prayer). But the roof platform of the minaret was not used as a lookout due to the concern for visual privacy implied by Islam. The *moathen* is prohibited from looking down when submitting *athan*.

2) Construction

Historically, master builders and masons familiar with indigenous building traditions were responsible for the construction of towers. Inhabitants of a settlement were also involved in the building process. Generally, the relationship between a master builder and the local people depended on social and economic status. Wealthy settlements had well-cut stones for their towers, and such towers needed the skills of a master builder, who would command stone carvers and masons who innovated within traditional patterns.

Decisions as to where to build towers, walls, and fortified gates, however, were taken by the *sheikh*, *amir*, or ruler. This local official would normally consult with heads of local groups and with the overseers who participated actively in all stages of buildings process. All inhabitants of the settlement (both men and women) helped in construction. In the building process, the master builder or mason would prepare the adobe or cut the stone, while the local men and women would work on the preparation of materials.

On the job site, there might be specialists in all branches of construction. There might be the adobe-brick makers who prepared the adobe by pouring it into rectangular wooden frames and then leaving these to dry in the sun. Stone cutting required exceptional physical strength and skill, especially in times of hand labor. There were also specialists in plastering and decoration, and carpenters who manufactured doors and windows and cut wood for floor supports and roofs. The most important tradesman, however, was the mason. It was often his responsibility to design the structure, construct it, and coordinate the work of other technicians.

Construction systems for towers varied by region. In central Arabia *murgab* were built of carefully selected and treated adobe with stone foundations, while in Al-Bahah *husun* were built completely of stone. Here the foundation was called *rabadh*-which can be literally translated as "sitting camel"-a metaphoric term used to designate its ability to carry the load above.

Husun (plural of *husn*) were constructed of rectangular rubble-stone blocks set without mortar. *Husun* were usually constructed to a height of five to six stories.

In some places in Asir, *qasabat* were built of mixed stone and adobe. The stone was used for the foundation and the ground floor, while the adobe was used for the higher floors. The adobe courses were adorned with *ragaf*, pieces of slate that project 15-20 cm. from the wall to deflect rain. Adobe walls were built in two ways. One was to dig down to a firm sub-base or rock and lay a stone foundation; adobe bricks of equal size, joined by wet mud, could then be built up into the walls, and the walls could be plastered on both sides with a mixture of clay and straw. The second way was to lay mixed adobe in a system of free courses, named *ḥorg*, each about one cubit high. In this system, the higher the wall rose, the thinner it became. Walls built in this way did not require plastering and may not have needed stone foundations. Inside, the multiple floors were often supported on columns built up of round stones held together with gypsum and plastered to achieve greater strength and a more attractive appearance.

3) Transformation: The emergence of new type of towers

This work attempts to understand the transformation in towers in light of the ecological and historical context in which they were built and used. This study explores the process of transformation that produced modern towers. It is very difficult to arrive at any assessment of the environmental quality beyond the influence of the values and meanings people usually establish in the process of the adaptation to their native environment or more broadly their ecology.

Transformation is a process and a phenomenon of the change of form under altering circumstances [20]. With these changes, architecture is transformed to reflect the current climate of transformation: traditional, transitional or contemporary. The transformation principle applied to towers considers the semiotics of the new emerged form that would replace the traditional towers.

Transformation in an object is usually based on the critical, selective and inventive process of a living tradition and practice of rituals, not simply concerned with the mechanical and literal replication of originals. It addresses both essence and form, not only appearance.

For example, the prison tower which is a transformed version of the warning and defense tower, is considered as a miniature both in its volume and role in micro-environmental surveillance. Transformation processes enhanced the wall of the prison similar to the fortified tower which prevailed during the traditional period. It was then reborn during the transitional stage.

Another facet of transformation in towers is determined by changes in the socio-cultural, political, economic, technological and environmental contexts which determine the new patterns and forms in the tower typologies like the TV tower in Riyadh.

Transformation is a continuous process affecting both the production of towers and the human relationship to the new product.

The transformation process establishes a dialogue between the designer of the tower and the decision maker not necessarily the user. This dialog allows the meaning to be related to the cultural, economic, political and technological imperatives that guide the development process.

The modern transformation is formal and enforced. In some cases, especially minarets, the spatial codes in tower architecture are occasionally indicated by traces to the original towers.

4) Incentives to tower ecological architecture

The meaning that tower forms possess before transformation is neither retained nor entirely eliminated by the traces to original forms. The traces exist as an intermediate domain that cause new meaning to emerge as part of the ecology of the built environment and wilderness. The ecological variables are limited to the functional and natural factors (climate, topography, material and tower typology). The interrelationship between these factors when cross-examined on different ecosystems of traditional settlements and wilderness reveal meanings. In many examples of the traditional towers of the Arabian peninsula one can find design features that reveal certain ecological notions. The different ecological conditions can be utilized to set standards and norms to embody meaning especially when the towers possess ecological architecture which fits with the natural environmental factors, namely climate, topography and material.

Architecture should have an identifiable essence with place. Place is identified with its natural factors (climate, topography and material), building typology and cultural norms. It is the dynamic interaction of all these ecological variables that makes building tradition unique to a place or ecological system.

Natural factors that act upon the generation of the built environment consist of climate (sun, wind, precipitation), topography (flat or slop) and availability and types of materials that can be utilized for building.

In order to create suitable functional conditions, the designer transforms these natural factors for practical use [21]. This transformation process is not always the correct utilization of these available means. It may bring about a change in the ecosystem depending upon the societal attitudes and motivations. While the purpose of the tower environment is to enhance stress which may develop due to the characteristics of the physical environment, the built environment becomes part of the ecosystem which may create additional strains upon the environment itself. That is to say, if the stable conditions of the ecosystem are forced beyond the limits of resilience, there occurs a reciprocal effect of changing patterns of human activity upon the environment. The user

thus begins to alter this functioning environment. This implies the designer's attitude in interpreting nature's properties for settlement formation.

Translated into design, this means that design should be more active. The morphology of the tower that emerges out of design considerations such as orientation, use of proper building materials, the place and size of openings, clustering, landscaping and archetypical solutions provides room for dynamism.

In addition, among the many influencing factors in shaping the type of tower one can see a concern for the generation of a micro-climate in building through architectural means and nature.

Concluding Remarks

The interaction between physical environmental factors and tower architecture provides a ground for vernacular tradition and establishes norms for ecological design. Established norms result from a deep understanding of the inner dynamics of nature. These are incentives for the development and continuity of ecological architecture when the natural environment and micro environment become part of the process that includes finding, the intrinsic qualities of the context and exploiting them. The design of an ecological work can not be solved with pre-conceived forms as is done in today practice. Tower ecological design should express the significance and assets of the environmental factors. Through ecological architecture, architects pay attention to the interaction between culture and the context. The following remarks should help put this claim in context:

- The sensitivity of the setting of tower on the topography is recognized as a formal factor. The proper setting results in environmental values inherent in it. The nature of buildings is born from the nature of land, design and materials.
- The responsiveness of the tower depends on how it responds to the restrictions of local climate.
- The appropriate use of building materials and techniques sharpen the distinction of the tower.
- Ecological architecture is a best fit between cultural needs and form.

The search of tower typology is a useful analytical tool for ecological architecture with three basic functions. (1) It corrects misconceptions and confusion by systematically classifying related concepts. (2) It effectively organizes knowledge by clearly defining the parameters of a given subject. (3) It facilitates theorizing by delineating major subparts of distinct properties and provides foci for further research.

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تصنيف الأبراج: البحث عن حافز لعمارة بيئية للأبراج في مدن وفيافي المملكة العربية السعودية

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مخلص البحث. تقدم هذه الورقة تصنيفاً للأبراج العديدة والمنتشرة في مدن وفيافي المملكة العربية السعودية، وذلك بهدف تحديد هويتها الرمزية والتعرف على القوى والجهود والأفكار التي كانت وراء تشييدها. إن مثل هذا الإرث المعماري له دور مهم في تركيبة البيئة المبنية وفي البرية التي حولها. تناقش الورقة سبل الحفاظ على هذه الرموز المعمارية والبنائية خاصة فيما يتعلق بالعلاقة بين هيئة البرج والفراغ الحضري حوله والتنسيق العمراني التقليدي للبيئة المحلية.

يتركز مفهوم العمارة البيئية حول ملاءمة البرج أو مجموعة الأبراج للبيئة العمرانية مثلها مثل الكائن الحي أو مجموعة الكائنات الحية في منظومة الحياة. والعلاقة بين مفهوم البيئة الحية إلى العمارة تظهر في الأصل اللغوي للبيئة الحية، والحجة الرئيسية هنا هي أن العلاقة بين الثقافة والطبيعة والبيئة المبنية في حقيقتها هي البيئة الحية. وبمعنى آخر أن البرج يكون أكثر من مجرد عنصر إنشائي لاحتواء الأنشطة الخاصة بالإنسان. ويكون الفهم الجديد لتصميم مثل هذه الأبراج أشمل من وجهة النظر البيئية وأكثر من النظرة الضيقة لمفهوم العلاقة الآلية بين العمارة والطبيعة بوجه عام.

تطورت هذه الأبراج مثلها مثل القلاع منذ زمن طويل كمنشآت للإنذار والدفاع عن حمى القبائل المتناحرة في الزمن الماضي، ولكن بعد توحيد المملكة العربية السعودية في عام ١٣٥١هـ/١٩٣٢م لم تعد هناك

* يشغل في الوقت الحاضر منصب عميد الكلية.

أهمية لهذه الأبراج فصارت رمزاً لفتح جديد ، وكان لظهور منارات المساجد في القرن الأول الهجري /السابع الميلادي وأبراج تهوية وتبريد المباني وفنارات هدي السفن وحتى خزانات المياه وهوائيات الاتصالات وأبراج مراقبة حركة الملاحة في المطارات دور في تنوع هوية ورمزية الأبراج.

يستخلص البحث أن التغيير الكبير في مفهوم الأبراج وهويتها ورمزيتها في الوقت الحاضر ظهر نتيجة لتعرض المجتمع السعودي لعدة قوى وتغيرات كان لابد منها لكي يواكب التطور العالمي.