

Environmentally Responsive Education in Urban History

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ABSTRACT: Admiration for environment in general needs to be profoundly rooted in an understanding of History. Urban history is unique not only in the fact that it reflects climate but also in that it cuts across many different fields. In most schools of urban studies many aspects of science and technology are taught with relation to design in order to attain skills for practice. During a student's later career they may not lead to a respect for environment, and do not lead in particular, to an understanding of energy issues and climatic impacts on urban form. The aim of this paper is to stimulate the environment consciousness of urban history instructors as well as researchers. It demonstrates similarity in spatial aspects of settlements differing in cultures and tradition but similar in environment. The examples range from ancient to present day urban configurations.

Keywords: *Environment, Education, Urban History, Responsiveness.*

INTRODUCTION

Education in the field of urban design should include an extensive knowledge of the history of urban form, specially the subject of climatic impact on urban areas. "Climate-conscious urban design history" is a new field of research yet to be explored; work carried out so far barely scratches the surface. After investigating more than two-dozen books specifically on the subject of history of urban form, I am convinced that there is not even one reliable and complete source for use as reference on climate and energy needs. Historical documentation of human settlement and architecture has mostly dealt with the external form of habitable volume, environmental psychology, sociological aspect, etc. "The historian and critics of architecture was, and is still, concerned primarily with matters of structural style. The art, rather than the science of architecture, is still taught and practised in historic terms. ...A building was still to be judged by the impact of its exterior on a sophisticated observer. Little or no comment was made on its performance." [Mulchay, 1970, 57] The fact that nature has covered and affected the whole of the technological art of creating habitable environment on any scale has not been appreciated. Climatic factors have been ignored for far too long. Even differences in social behaviour pattern have been ascribed to climatic influences; a speculation which

has received scientific verification in recent years. [Andersen, 1990, 4]

Research on climatic aspects of urban form history is unique in several aspects; it overlaps with many different sciences and branches of human behaviour and many fruitful fields of research could be crystallised. As was written in an excellent book called "The Pursuit of Urban History": "It (Urban History) cuts a cross-section of that diverse and complex field of historical enquiry which is concerned with the human experience of, and in, towns and cities." [Fraser, 1983, xi]

Climate in Perspective

Climate meaning "steep" (from Greek: Klima), is defined by the Oxford dictionary as "Region with certain prevailing conditions of temperature, humidity, wind, etc.". When human comfort and environmental design are the concerns, the principal climatic elements are: solar and longwave radiation to the sky, air temperature, humidity, wind and precipitation. The climate of a given region is determined by pattern of variation of the above elements and their combinations. There are also other physical environmental factors which on a regional scale would interact with these elements, such as: topography, latitude, altitude, and proximity to bodies of water or desert. Further exploration of technical aspects of climate is not necessary for the purpose of this paper. Let the great urban historian, Louis Mumford put

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the climate into time-perspective: "No less important is climate. The climate belt in which cities have flourished is a broad one: ...Climate does not so much limit the existence of cities as individualize the type of urban adaptation. Each city has its characteristic play of weather, set off against its landscape: ...One further influence of climate: it effects upon habits of eating and drinking." [Mumford, 1983, 317]

Energy Crisis and Cities

The use of natural gas and oil started in the 1850s and it is forecast that available resources of these fuels will be exhausted by the early 21st century. Therefore the present energy modes should be examined with a view to reducing the consumption, specially the demand for oil. Fossil fuels are too precious to burn; they should be used wisely and not wastefully and not for the purpose of cooling or heating, etc. We should create a deep awareness for people and pupils alike that polluting fossil fuels unlike clean solar energy are not renewable or free. We are able to make better use of renewable energies and the technology exists to assist us. There are so many renewable and free energies all around us, waiting to be exploited. The word "Energy Crisis" goes far deeper than simply a shortage of fossil fuels. The crisis is generated by the reluctance to adapt the use of innovative and less energy consuming solutions for human settlements. Whether energy prices go up or down, efficiency will continue to bring great rewards. Here follows a tip that will more than pay for itself, and will help protect humankind from the vagaries of the unpredictable world energy market: Make our cities responsive to climate and conservative of energy.

Climate Responsive Cities

Prehistoric man knew the principles of finding a cave or shelter that had openings orientated toward the sun, in order to take advantage of its warmth during winter days. He also discovered how certain materials retained the heat and could radiate it back during colder weather or night times. Early buildings and urban configurations were shelter against negative climatic elements and open to positive ones and were planned so as to modify the diurnal climatic elements. These urban centres evolved throughout history according to inhabitants' needs and depending on characteristics of their climate. The natives learned to understand the nature of their climate and the nature of climatic stress imposed by the region. When ancient civilisations began to plan their cities, they continued to follow and improve the same basic concepts, the fruit of their experience. These concepts evolved to meet the bioclimatical needs of human being living mostly in the stress climate. They dealt with the limitation of resources and showed concern for conservation of their environmental characteristics. These early urban planning and design experiences emphasised:

- Compact to Dispersed Urban Density Form and Zoning
- Careful Site and Orientation Selection
- Selection of Suitable Placement: Slope, Flat or Reverse Site

• Morphological and Directionality Aspects of Arteries

Almost all early urban planning was "Climate" oriented; there are numerous examples to be discussed. Just for the purpose of illustration, mention of a few ancient cities in different parts of the world that are clearly organised with the above strategies could include: The city of Mohenjo-daro in Indus Valley by Harappan from twenty second to seventeenth century BC; The city of Knossos in central Crete by Late Minoan in around fifteenth century BC; The city of Arg-e-bam in Persia during Sassanid period in fourth to second century BC; The city of Teotihuacan in Mexico by Aztecs in first century BC to sixteenth century AD; The Chinese capital city of Ch'ang-an during the T'ang dynasty in seventh to tenth century AD, etc. The first overall observation and suggestion about these and many other ancient urban centres is that, interestingly, they are concentrated between the Tropic of Cancer and the Equator with occasional deviation toward or away from them. "The relationship between climate and location of Centres of early civilisations throughout the world is most striking. All were situated in areas close to the 70°F isotherm and where wide summer to winter variation were not excessive." [Mulcahy, 1970, 57] Each of these cities demonstrates a clear understanding of their special environment and climatic characteristics, use of solar energy and ventilation planning and a profound organisational ability in response to orientation, heat loss and gain, density control, artery design, architectural elements, and so on.

The ancient city of Priene located on the southern coast of Turkey today, was built from around 350BC onwards. The 4000 residents of old Priene abandoned their city because of continuous flooding. The Priene plan (Fig. 1) was laid out on a grid pattern concerning the cardinal point and sloping in a south-easterly direction, and the streets were similarly orientated. The seven primary terraced streets (7 meters wide) following the contours, were mainly for vehicular ways along the east-west axis with less slope; and there were fifteen paths (4 meters wide) for pedestrians on the stepped north-south axis for better exposure to summer Mediterranean sea breeze and winter sun. The Agora and most public buildings were placed in the heart of the town for balanced pedestrian distance. For better southern ventilation of houses and structures a medium to high density planning was implemented in the form of steps. All the buildings' arrangements in Priene had good solar axis, as the excavator, Theodore Wiegand, has called it: "The solar building principle."

One of the best examples of solar planning is the village-cave of Longhouse by Anasazi, Indian-Americans. This village-cave and many others can be seen today in the extreme southwest corner of Colorado in an area called Mesa Verde. It is speculated that human beings have inhabited the region for twelve to fourteen thousand years and vanished by 1500 AD. There are about 200 crescent shaped village-caves (Fig. 2) and each had a population of between 500 to 2000 people in this semi-arid region. The Indian builders of the eleventh century

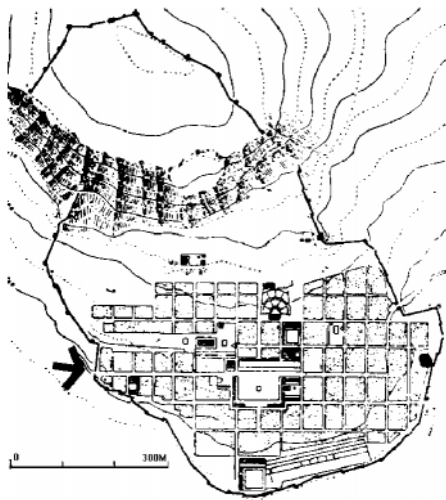


Fig. 1: City of Priene [Morris, 1979, 28]

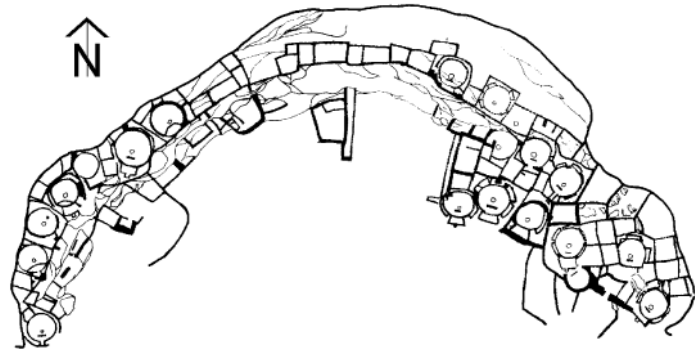


Fig. 2: Plan of Longhouse Village-cave [Knowles, 1977,22]

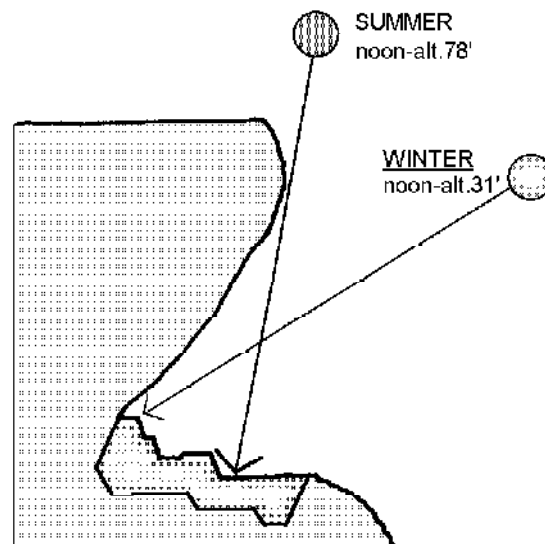


Fig. 3: Section of a tyFigal Village-cave

of Longhouse took advantage of the south orientation that provided a unique combination of summer shadow and winter sun, showing their clear understanding of the sun's movement. Visiting these village-caves in mid-summer one would find the cave walls, building surfaces and village open spaces almost entirely shadowed by the brow of the caves during the hot part of the day (Fig.3). Another visit in mid-winter would demonstrate that the spirit of shelter and community are still present but defined in a different way. Spaces that were cool in summer would be warmed by the rays of the low winter sun, and at the same time the whole village is protected from rain and snowfall by the great brow. Another piece of research has proved that measurements of energy incident upon the buildings and cave surfaces have shown that summer and winter are very nearly

similar. The village-caves not only protected the inhabitants from weather and enemies, but could also significantly balance the effect of seasonal thermal variation in this environment. "The Anasazi culture rose, flourished, and then vanished over a period of approximately 1300 years. ...this culture left behind an extraordinary testament to their achievements in the stone structures at Mesa Verde." [Tabb, 1984, 5-6]

Travelling around the Iranian plateau, with a diverse weather and topography, we can see the extent of the role climate has played in shaping the urban fabric of towns and cities. These urban centres are still alive and functioning today; they differ in size and scale with inhabitants of 500 to 500,000, some dating back to 500 BC. Settlements may be hundreds of kilometres apart, but in the same types of climate, similarities

in urban morphology and physical form are striking, and the skilful touch of the same sculptor, "Climate", is sensible. The examination of these settlements could be extremely valuable as living workshops in the study of relationships between urban form and climate.

The settlements in the centre of the plateau with hot-arid and semi-arid type climate that cover two-fifths of the country are the most unique area. The most important climatic urban elements (Fig. 4) that shaped the spatial form of these arid and semi-arid regions could also be similar to anywhere else in the world with the same type of climate and could be summarised and classified:

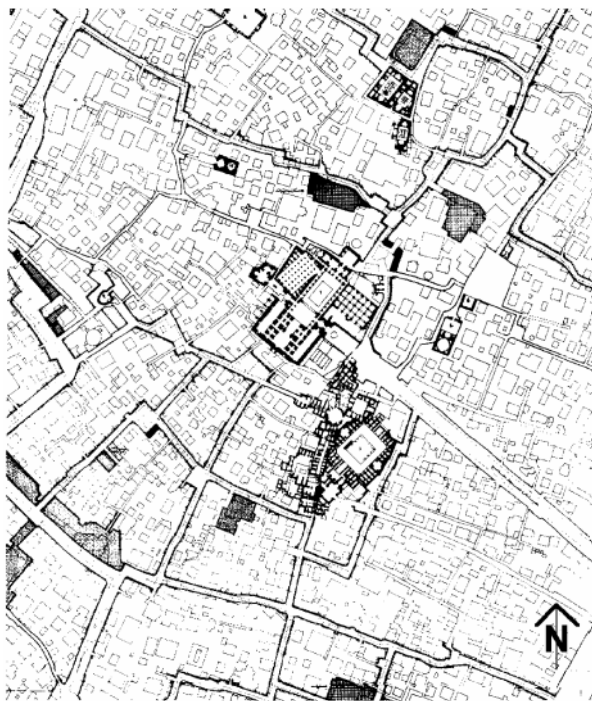


Fig.4: Yazd city centre, Iran [Tavssoli, 1990, 24]

* Compact city and zoning planning:

- To reduce contact with sun radiation;
- To increase the shadow pattern for inhabitants;
- To create cool and comfortable indoor and outdoor spaces.

* Narrow, winding and diagonal direction of arteries:

- With high walls, they create a cool shaded refuge;
- To channel the cool breeze for pedestrians as well as vehicles;
- Covered pedestrian commercial ways: "bazaar", act as a primary cool and shaded movement system.

* Architectural elements:

- Courtyard in different shapes and spatial form;

- Form of roof cover primarily in shape of dome and vault for open and close spaces;
- Wind-catchers: "budgir", in many different sizes, height and directions according to specific breeze characteristics;
- Material selection with suitable colour, brightness and density depending on the element to be used, etc.

* Water and vegetation:

- They have motivated the fundamental concepts for designing all elements from macro to micro scales;
- As the key ingredient of all other elements;
- For channelling of warm breeze over water to create a comfortable micro-climate;
- To recreate paradise in form of a garden.

These are the prime strategies that have created an extremely comfortable environment for the inhabitants of hot-arid and semi-arid regions for over thousands of years as one of the main areas of civilisation. Gideon Golany and most urban historians believe that: "Most of the early urban civilizations of the world emerged in the hot-arid or semi-arid regions, primarily in the Fertile Crescent of the Middle East and in the Nile region." [Golancy, 1983]

In the European Roman empire from Augustus' rule in the first century AD until the fall of Rome, urban energy planning for the purposes of space heating, greenhouses and residential applications was apparently widespread. There were even restrictive laws for sun axis rights. "...the heliocaminus or "solar furnace" room was common enough to provoke disputes over sun rights requiring adjudication in the Roman courts. ...judgement was incorporated into the great Justinian Code of Law for centuries later: If any object is so placed as to take away the sunshine...it is a violation of heliocaminus' right to the sun." [Butti, 1981, 27]

After the fall of Rome, European architects and urban planners almost virtually ignored the principles of energy planning for almost one thousand years. "...The classical writings on solar architecture of Socrates, Aristotle, Vitruvius and others fell into disuse. ...A few examples of indigenous solar architecture continued to flourish in some areas of Europe, but the main centers were not planned for the sun." [Butti, 1981, 159]

In the early 1860's, the United Kingdom started to house her working class in communities that let the sunlight into the indoor living spaces, streets and open community centres. "Port Sunlight" is a solar-conscious housing project that was planned, designed and built mainly by Lever Brothers for the administrative and working class of the Sunlight soap factories. According to one observer: "...As the developers boasted, the worship of sunshine is characteristic of every building in the village. ...Roads varying in width ...separate the various blocks, so that the air and light can penetrate freely on all sides." [10-p.162] The new British planning and design in the mid-nineteenth century did not create an immediate revival as the Ancients' one had done. However these projects could

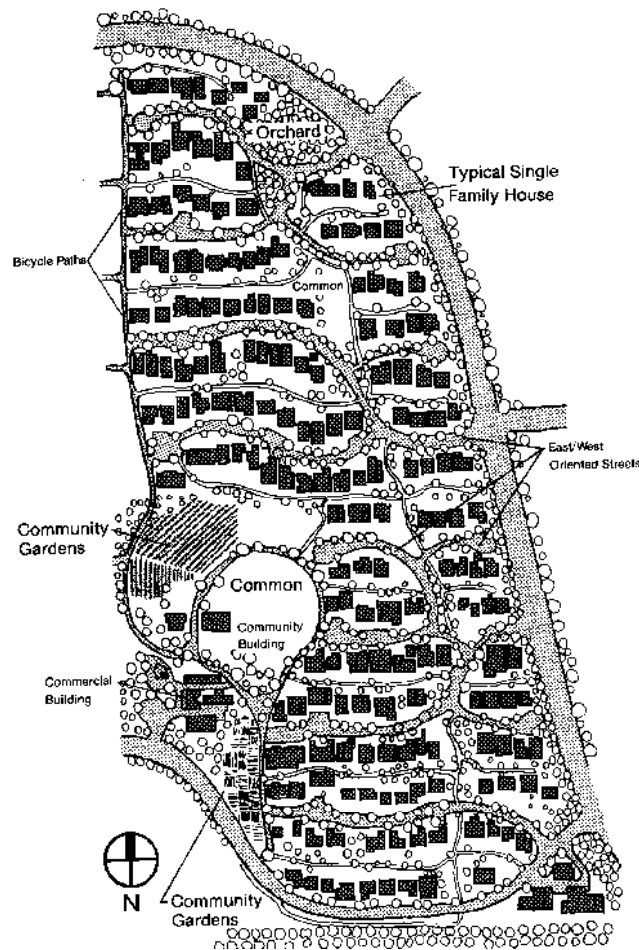


Fig. 5: Village Home, California [Tabb, 1984, 22]

be considered as a reaction especially from the working class and specifically from some planners and architects to "The intolerable industrialisation created living condition".

In the late nineteenth century the possibility and technology of indoor climate control under the shadow of cheap fossil fuel in the form of electrical lighting, mechanical ventilation, refrigeration and heating revolutionised building design and construction. It seems that the revolution took place in the absence of urban designers, planners and architects. Ralph Knowles suggests: "Modern American building has had no solar ethic to guide it. Development has taken place since very early within a framework that does not recognize the sun as a generative force. The purpose of our Jeffersonian grid was to facilitate rapid expansion. Certainly that purpose has been satisfied! The growth process has occurred by subdividing the standard mile square agricultural section. ...Orientation in such arrangements is toward the street, rather than toward the sun." [Knowles, 1978, 842] When there are abundant amounts and sources of solar generated energies on hand just waiting to be loved, it would be unwise to romance with technology and fossil fuel; it only fulfils human desires for short periods of time.

The 19th and 20th century trend toward dispersed prototype urban and non-urban development directly reflects the character of the economic institutions that govern most societies. A connection is missing that has generated different climatic urban forms for thousands of years - as we have glimpsed - before the discovery of polluting fossil fuel energies. The industrial cities of the 18th and 19th century, and the present-day corporate versions have introduced distinctive urban morphology with all the problems that this has caused. At the time of cheap energy of the 1960's, the megacity or concentrated supercity was born, that captured the imagination of many urban designers and planners. The megacities were too expensive to build in terms of the energy they consumed and they do not meet the demands in terms of being energy efficient in their urban form and structure. On the other hand the urban designers of the near future have to become more energy-conscious for their survival than the megacities' designers of the mid-twentieth century.

After the "Energy Crisis" of the 1970's a new era was started by a few dynamic groups and professionals. Village Home Sub-division in Davis, California (Fig.5) initiated in the seventies is one of the early attempts at climate-responsive community design and solar

architecture. In phase one, 200 solar homes with a density of three units per acre in a careful and organised, yet informal way. All amenities and supportive buildings, spaces and outdoor activities acted as a central magnet for pedestrian foot paths. Arterial access streets ran parallel to the site in a north-south direction, and feeder streets into the development were in an east-west direction. Greenhouses, direct-gain windows, clerestories and distributed and concentrated thermal masses were employed for producing heat and domestic hot water. Many energy-conscious techniques were used to reduce both the heating and cooling loads. This village consumes 50 percent less energy than neighbouring developments. It demonstrates that energy-conscious town planning is possible in this warm-humid climate.

There have also been many competition around the world with energy-efficiency as the prime goal since 1973. In 1978, the International Union of Architects in Mexico held a competition which was open to schools of architecture around the world. The competition was to design, in any chosen location a town-centre or village for 10,000 to 50,000 people for a local government. "...The entry from the Sheffield school selected a location at Cave Hill in Barbados, ...(There was)continuous sunshine and, equally important, continuous though low-velocity breezes on an exposed site, ...Barbados has an abundant supply of pure water, naturally filtered by the coral, and rotary windmills were proposed to pump the water up to troughs on the roof canopies to effect cooling by evaporation." [Gosling, 1984, 69] The main goal was to devise new forms of both urban and building design to reduce dependence on electrical air-conditioning by simple available resources.

CONCLUSION

- The surviving archaeological evidence, specially the ruins of many remaining historic cities, suggests that humankind could have become extinct, if it had not been in harmony with nature and the climate that embodies it. Protection against climatic elements appears to have been the main concern rather than "Invasion by enemies". Cities in the same isotherm but of different cultures were planned with the same urban planning, design and

architectural vocabulary, since it was the only way to make them work with the amount of renewable energy available.

- Historians should make a great effort to interpret more subtly the impact of energy and climate on the history of human settlement and urbanisation. This could be a great contribution to the future of the profession of urban designers and planners, as well as that of researchers and students. This effort represents a small fraction of what is left unsaid; it is a tentative beginning that should be manifested in the research to be dealt with.
- The city is the vast energy consumer in need for new solutions and the solution to the cities' energy problem will be the major world concern in the near future. Without the city as a major consumer the attraction to use natural, renewable forms of energy will be too small. Sooner or later Climatized cities will be the start or breaking point of the Solar Era.

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