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Table 6. Comparing the qualities of Natural urban edge in three case studies of the research. Source: authors.

| Criterion | Pushkar lakefront condition | Ganga riverfront condition | Arabian sea coast condition in Mumbai | Conclusion |
|--|---|---|--|--|
| Linear form | Linear form overlaying the lakefront | Naturally , the river waterfront has a linear form | Linear form overlaying Arabian Sea waterfront | All three edges are linear |
| Extroverted function | In contrast to path which is a linear introverted element in the image of the city, the edge is and extroverted element. The waterfront edge along the water is defined by presence of citizens and it is always considered as extroverted. Although there are rituals for taking a religious bath in the sacred lake, the prominent role of the edge is considered as extroverted. | The river edge is the place for gathering of inhabitants and tourists. Nevertheless, a few enter the waters for boating | Eligible of extroverted function and mostly visited for viewing the shore or used as a wharf | The all three edges have extroverted functions; however, this does not seem to an appropriate and clear criterion for defining the edge |
| Border between two parts | The edge is a clear border between the land and water and obviously defined. | the Varanasi river has divided the city into two parts | This seashore is the edge of Indian peninsula | All three edges have defined the border between water and land. |
| Form continuity | Having continuity alike all waterfront edges | The river has a completely continuous form (alike most coastal edges) while the coastline is interrupted in some places and continuous movement is not possible. | Belonging to the public, the shore has a continuous edge. | Pushkar and Mumbai waterfront are completely continuous. Although the Ganga river waterfront does not allow continuous movement, it is visibly continuous |
| Easing navigation and route finding | As the most significant element of the city, the lake eases the urban navigation. Nonetheless, due to being a lake, it can't be efficient as a river or the sea. | Historically, the city is defined linearly according to Ganga river and this edge has an important role in navigation and route finding | As the most significant element in the image of Mumbai, it defines the cognitive map of the city | The river edge and the sea edge ease navigation and route finding; however, the lake edge helps navigation less. |
| Social role: public space | The edge is susceptible for various public functions that are mentioned in the following. | Various activities including taking a religious bath, personal cleanliness and washing, holding religious ceremonies and incinerating the deceased take place all together. | As shown in Fig. 4, it is used as a public space. | Regarding the sanctity of water in the discussed cases, these spaces provide a context for gathering and holding ritual ceremonies though we should prudently speak about the transformation of these public spaces to the civil life context. |
| Economic role: presence of various functions | A market row is created along the edge of the lake | Routine religious functions (temples) as well as peddlers and commercial units | People, peddlers, recreational and coastal activities are formed by each other. | All three edges have serious economic role. |
| Landscape role: defining city identity | As a sacred lake for the Indians, it plays a key role in defining the city identity | The city formation base dates back to ancient ages | Mumbai city is considered a coastal city which is significant in defining the economic role of the city. | All three edges are key role elements in defining landscape and city identity. |
| The presence of natural prominent and obvious elements | The general topography of the city is coordinated with lake water and the lake has become the most prominent element of the city. Correspondingly, the edge of the lake is considered as a prominent element as well. | The river edge is a natural element in which religious beliefs and Hindu rituals are mixed | Arabian sea is a significant element which connects the city to waters of Indian ocean. | There is a natural important element in all three researched cases. |
| Human and nature relation | The presence of human and a variety of animals in an attractive natural environment | Although Varanasi is considered a polluted city, the Hindus believe that the miracle of Ganga river is remaining clean despite the pollutions. The river edge is a place for relation of human with water and fire. | The presence of human and a variety of animals in an attractive natural environment | All three spaces embed human and nature relation |

Conclusion

Having discussed the three natural urban edges in cities of India, some features of these edges were recognized. The following table provides a comparison and specially similarities of these edges. Indeed, this table is derived from the previous three tables (Table 5).

Having described the anthropology and geography of the three regions, this paper was analyzed in eight categories of “the experience of connecting to nature, becoming a significant and symbolic element, performing a ritual role in all ages due to the partial stability, directing toward urban topology, formation of the city under the influence and along the natural edges, accretion

of commercial functions along the edge axis, human activities and gathering of citizens and affiliation of urban edges to the public and absence of private ownership” in three cases studies in India (Ganga river in Varanasi, the edge of Pushkar Lake and the edge of Mumbai waterfront).

According to common categories and explanations, it can be indicated that the creation of commercial functions, ritual spaces, public spaces and people’s presence and interaction along these natural edges can be concluded as the results of the urban edge overlay on the natural edge (Table 6).

Table 5. Features and functions of natural urban edges on Indian coasts. Source: authors.

| Functions of natural urban edges | |
|--|--------------------------------|
| 1. the experience of connecting to nature | 1. space memorability |
| 2. Becoming a significant and symbolic element | |
| 3. Performing a ritual role in all ages due to the partial stability | |
| 1. overlaying of navigation in the edges and urban topology | 2. urban perception legibility |
| 2. Formation of the city under the influence and along the natural edges | |
| 1. Accretion of commercial functions along the edge axis | 3. creation of a public place |
| 2. human activities and gathering of citizens | |
| 3. affiliation of urban edges to the public and absence of private ownership | |



Fig.4. The presence of people, peddlers, birds and different activities on the seashores of Arabian Sea.
photo: Zahra Askarzadeh,1391.

Table 4. qualities of natural urban edge in Mumbai seashore. Source: authors.

| Criterion | Arabian sea coast condition in Mumbai |
|--|--|
| Linear form | Linear form overlaying the edge of Arabian Sea |
| Extroverted function | Eligible of extroverted function and mostly visited for viewing the shore or used as a wharf |
| Border between two parts | This shore is exactly the edge of Indian peninsula. |
| Form continuity | Belonging to the public, the shore has a continuous edge. |
| Easing navigation and route finding | As the most significant element in the image of Mumbai, it defines the cognitive map of the city |
| Social role: public space | As shown in Fig. 4, it is used as a public space. |
| Commercial role: presence of various functions | People, peddlers, recreational and coastal activities are formed by each other. |
| Landscape role: defining city identity | Mumbai city is considered a coastal city which is significant in defining the economic role of the city. |
| The presence of natural prominent and obvious elements | Arabian sea is a significant element which connects the city to waters of Indian ocean. |
| Human and nature relation | The presence of human and a variety of animals in an attractive natural environment |

The third case study, Arabian Sea coast in Mumbai

Mumbai is the capital of the Indian state of Maharashtra and the largest Indian harbor in western part of the country. This coastal city that has a natural coastline edge is considered as one of the most important commercial and economic centers. The coastline in this city is a center of social activities and public life. Numerous hotels, department stores and modern buildings are located alongside the coastal line. Activities such as boating, horse riding, cricket, acrobatics, dancing, performing festivals and annual events and numerous other entertainments take place on the coast. The annual festival of worshipping Ganesh (the Hindu deities) is held between August and September for 10 days across India along the coastline.

“Haji Ali Dargah,” mosque and shrine is a religious place for Muslims that is connected to the coast with an approximately one kilometer path and built in the middle of the sea. The building was built in 1431 AD and usually more than 40 thousand pilgrims visit this place on Thursdays and Fridays. Sitting on the seashore and watching the sunset is a favorite act by residents and tourists. According to field observations, Arabian seashore offers the following functions:

1. Offering an experience of connecting to nature: The seashore edge of the city, along with the presence of birds and plants, is a place for

gathering of the citizens and connecting to nature.

2. Becoming a significant and symbolic element: the Arabian Sea coast is a prominent and identifying element of Mumbai.

3. Offering a ritual role: Most rituals, festivals and religious ceremonies take place on the sea coast of this city.

4. Directing the urban topology: Mumbai city is formed according to the coast which has been effective in formation of the city.

5. Formation of the city under the influence and along the natural edges: Mumbai is a coastal city located near the sea and surrounded by water.

6. Accretion of commercial functions along the edge axis: peddlers and people are seen on the coast selling and buying different foods and devices.

7. Human activities and gatherings of the citizens: Many people on the edge of the Arabian Sea coast in Mumbai are engaged in various activities including diverse games and boating while this place is place for comforting and resting after daily activities.

8. Affiliation of urban edges to all citizens: As was seen in all three samples, the urban edges belong to all people (Fig.4).

According to the field observations, the following checklist defines the qualities of a natural urban edge along Mumbai seashore (Table 4).



Fig. 3. Performance of ritual ceremonies at sunset and gathering of people along Ganga River. Photo: Zahra Askarza-deh,2011.

Table 3. qualities of natural urban edge in Ganga River waterfront in Varanasi. Source: authors.

| Criterion | Ganga riverfront condition |
|--|---|
| Linear form | Naturally, the river edge is linear |
| Extroverted function | The river edge is the place for gathering of inhabitants and tourists. Nevertheless, a few enter the waters for boating |
| Border between two parts | The river has divided the city of Varanasi into two parts. |
| Form continuity | The river has a completely continuous form (alike most coastal edges) while the coastline is interrupted in some places and continuous movement is not possible. |
| Easing navigation and route finding | Historically, the city is defined linearly according to Ganga river and this edge has an important role in navigation and route finding |
| Social role: public space | Various activities including taking a religious bath, personal cleanness and washing, holding religious ceremonies and incinerating the deceased take place all together. |
| Commercial role: presence of various functions | Routine religious functions (temples) as well as peddlers and commercial units |
| Landscape role: defining city identity | The city formation base dates back to ancient ages |
| The presence of natural prominent and obvious elements | The river edge is a natural element in which religious beliefs and Hindu rituals are mixed |
| Human and nature relation | Although Varanasi is considered a polluted city, the Hindus believe that the miracle of Ganga river is remaining clean despite the pollutions. The river edge is a place for relation of human with water and fire. |

Table 2. qualities of natural urban edge in Puskar lakefront. Source: authors.

| Criterion | Pushkar Lakefront condition |
|--|---|
| Linear form | Linear form overlaying the lakefront |
| Extroverted function | In contrast to path which is a linear introverted element in the image of the city, the edge is and extroverted element. The waterfront edge along the water is defined by presence of citizens and it is always considered as extroverted. Although there are rituals for taking a religious bath in the sacred lake, the prominent role of the edge is considered as extroverted. |
| Border between two parts | Edge is an obvious border between the water and land which is completely vivid and distinguished |
| Form continuity | Having continuity alike all waterfront edges |
| Easing navigation and route finding | As the most significant element of the city, the lake eases the urban navigation. Nonetheless, due to being a lake, it can't be efficient as a river or the sea. |
| Social role: public space | The edge is susceptible for various public functions that are mentioned in the following. |
| Commercial role: presence of various functions | A market row is created along the edge of the lake |
| Landscape role: defining city identity | As a sacred lake for the Indians, it plays a key role in defining the city identity |
| The presence of natural prominent and obvious elements | The general topography of the city is coordinated with lake water and the lake has become the most prominent element of the city. Correspondingly, the edge of the lake is considered as a prominent element as well. |
| Human and nature relation | The presence of human and a variety of animals in an attractive natural environment |

front has the following functions:

1. Offering an experience of connecting to nature: The presence of people on Ganga riverfront and watching the birds and other animals offers a place to communicate with the dynamic nature of the city
2. Becoming a significant and symbolic element: Ganga River edge in Varanasi is considered a prominent element and a symbol for the city.
3. Offering a ritual role: the river waterfront has become a place for religious and ritual activities due to the river sanctity in citizens' minds.
4. Directing to the urban topology: Varanasi slope inclines towards the river and affected by the river. The city development line is parallel to river waterfront and on its western coastline.
5. Formation of the city under the influence and along the natural edges: Ganga River is one of the oldest habitats of human life and ancient civilizations were formed at the edge of the river.

6. Accretion of commercial functions along the edge axis: The shoreline parallel to the river has embedded shops near the temples and buildings with different uses. Moreover, peddlers are engaged in economic activities in various parts of the edge and even a on a ride on boats.
7. Human activities and gatherings of the citizens: the riverfront has provided different spaces for activities and sitting places with different designs. Wide local shoreline and the parallel stairs are places for communal gatherings along the river or other activities such as sitting in a higher level and enjoying the river view.
8. Affiliation of urban edges to all citizens: Ganga riverfront without any private ownership is belonged to all people with different rituals and religions (Fig.3).

According to field observations, the following checklist defines the qualities of a natural urban edge along Ganga River waterfront in Varanasi:

city center and morphology of the urban fabric is formed in compliance with the lake.

5. Formation of the city under the influence and along the natural edges: Historically, city formation was always associated with water resources. Pushkar Lake presence could also pave the way for the formation and evolution of the city throughout history.

6. Accretion of commercial functions along the edge axis: a market row is created along Pushkar Lake which offers a linear axis for citizens and tourists.

7. Human activities and gatherings of the citizens: the surrounding stairs of the lake is designed in order to provide a public space. Indian citizens sit on these stairs and watch the sacred lake while having social interactions.

8. Affiliation of urban edges to all citizens: The absence of private ownership at the edge of the lake means that all groups of Indian people (many of whom are poor) can benefit from the

created space (Fig.2).

According to field observations, the following checklist defines the qualities of a natural urban edge in Pushkar lakefront:

Therefore, as observed, the Shore of Pushkar Lake plays a key role in lives of the citizens (Table 2).

Second case study, Ganga riverfront in Varanasi

Banares or Varanasi is a city located on the western shore of Ganga River and south-east of “Uttar Pradesh” state and considered as one of the oldest human habitats. The mentioned place is developed with the love of “Shiva”, the deities, and washed by the waters of the Ganga River. Every day, ritual ceremonies are performed along the river at sunrise and sunset. All the way to the temples and communal spaces are filled with different functions and buildings such as hotels, sitting places and shops.

According to field observations, Ganga river-



Fig. 2. The presence of buildings, residents as well as birds around Pushkar Lake, Photo: Zahra Askarzadeh, 2011.

edge of the lake is covered by stairs that lead to the urban fabric. In addition to being a pathway and an entrance to the lake, these stairs provide a space for religious gathering and ritual ceremonies. So, from the very beginning of the stairs (based on the rituals) it is necessary to take off the shoes and enter the basin bare feet to maintain the sanctity of the place.

Pushkar Lake is considered sacred for inhabitants. According to Hinduism, the famous lake water washes the sins and the body of people. Believers think the lake water is miraculous and cures all kinds of diseases and people wash themselves in the lake (Abram, 2010 : 192). A temple is located in the middle of the lake on a long stairway where the surrounding is visible. The desirable nature has resulted in the presence of various animals including birds and cows around lake and offers different alive atmosphere. Generally, the lake has become a landmark for the city and a center for a variety of activities.

Generally, the edge of Pushkar Lake offers the following functions:

1. Offering an experience of connecting to nature: This edge is a place for gathering of people around a natural lake. Moreover, different animals specially many birds live on the edge of the lake.
2. Becoming a significant and symbolic element: the edge of Pushkar Lake is one of the main symbolic elements in the city. The image of the city is generally formed due to Pushkar Lake.
3. Offering a ritual role: Pushkar Lake is a venue for Hindu religious ritual bath. Over the years, this event is done individually or in small groups of relatives in special days as a public ritual and with the presence of people from the adjacent cities.
4. Directing to the urban topology: The location of the Lake with a slope direction has caused people to easily find their routes. As shown in Fig 1. (Pushkar map) the lake is located in the

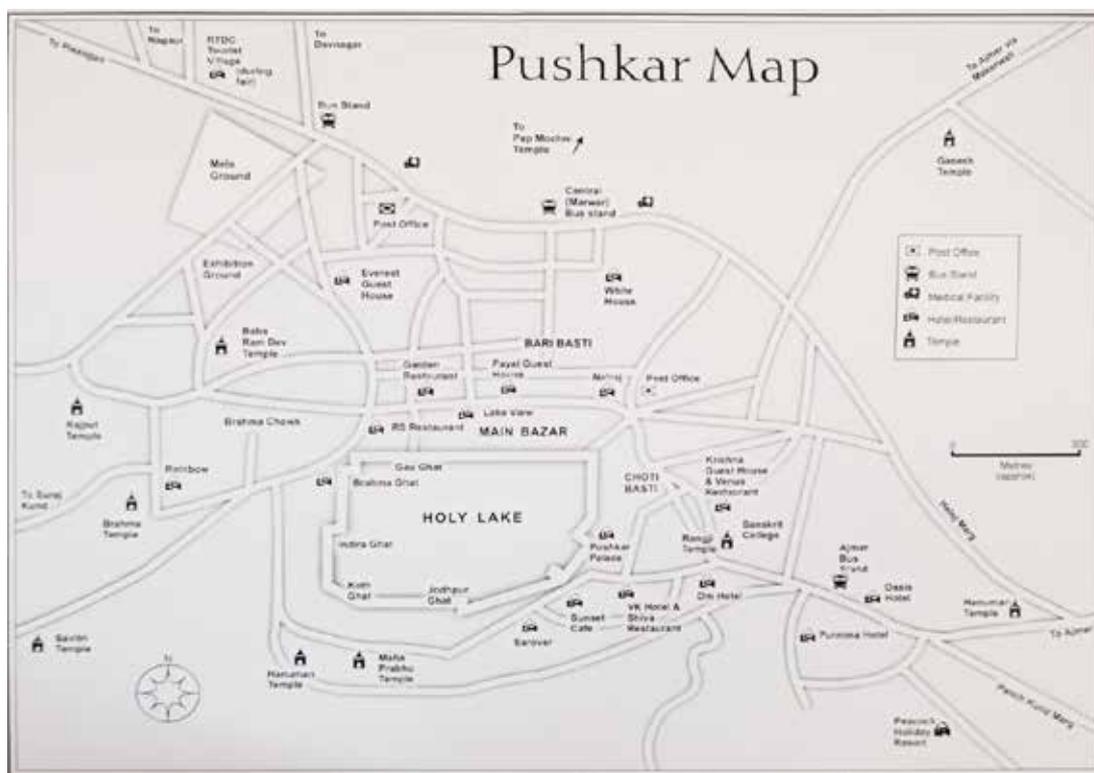


Fig. 1. Pushkar map and the sacred lake. Source: www.pushkarcamps.com

public space as well. Berlin wall is a built urban edge and the River Seine in Paris is considered a natural urban edge.

For a natural urban edge, which is the subject

of this article, some qualities are outlined. The more they have these qualities, the more legible they are. The following table shows some of these qualities (Table 1).

Table 1. Qualities of a natural urban edge. Source: authors, according to references cited in the table.

| component | criterion | source |
|---|---|--------------------|
| The qualities related to being an "edge" | Linear form Extroverted function Border between two parts Form continuity Easing navigation and route finding | Lynch, 2008 |
| The qualities related to being an "urban" | Social role: public space Economic role: the presence of various functions Landscape role: defining city identity | Yarahmadi, 2010 |
| The qualities related to being an "natural" | The existence of natural dominant and obvious elements Human and nature relation | Abdelraheem, 2010. |

This study tries to determine how much the edges of the Indian shores have been successful in creating these qualities. Moreover, investigating the natural urban edges in India might develop concepts and theoretical foundations that contribute to understanding of natural urban edges.

Research methodology

In order to examine the research hypothesis, three case studies were investigated in the cities of India. The first one is located in "Pushkar" city and near a sacred lakefront. The second one is "Ganga" riverfront in Varanasi and the third is "Mumbai" shore. This study analytically recognizes the functions of the edges based on field observations. In addition, it reflects the extent to which these three waterfront edges have been successful in creating the expected qualities according a checklist that is provided based on the Table 1.

First case study, Pushkar lakefront in Pushkar city

Pushkar is a small city with twenty thousand inhabitants in "Rajasthan" state of India and 14 kilometers north of the West "Ajmer" (www.rajasthantourism.gov.in). The city is one of the oldest cities in India with no precise date of construction and dates back to Hindu ritual stories and legends (Prakashan, n.d: 30). The most significant, and perhaps the only Brahma temple, is located in this city. This is one of the major reasons for its importance, and so is its sacred lake. This natural lake, located in the central arid climate part of the city, offers a completely different quality in a way that the city is formed around the lake and city houses are extended to the lakefront.

There is a market row parallel and behind the edge of the lake, which is the considered the main – with commercial function – street. Around the

Introduction

Perhaps the first study on image of the city and its elements can be attributed to “Kevin Lynch”. He introduced five basic elements of “node, path, landmark, district and edge” in his book “the image of the city”. Urban edge, both as a city border and the outer border of the city or a linear element in the city, is a significant element in formation of the city. Maintaining the quality

and dynamics of urban edge has a key role in the equal development, quality, image and legibility of the city. This article describes the functions of the urban edges which overlay natural features and discusses three case studies in India in order to understand how urban edges especially coastal edges (river, lake and sea) subjectively and objectively play a role in city structure.

Hypothesis

According to observations and studies on the Ganga riverfront in Varanasi, Pushkar lakefront and Mumbai shore, the natural edge overlay on coastal edges in cities of India has led to formation of natural urban edges. This natural-urban overlaying has been influential in creation of space memorability, urban perception legibility and creation of a public place.

Urban edge

Urban edge is a linear element, usually (but not always) is the border between the different sections and it is considered as a subordinate element in recognizing the image of the city. The strongest edges are the ones seen not only immediately but also observed with a continuous form (Lynch: 2008). Edges are linear, extrovert elements and mediates between two data fields. They configure the context for changing of space form (quality). Railways in the city, a sum of buildings and walls can be indicated as examples of an edge in the image of the city.

An edge is a subordinate element; not a balancing or symmetrizing axis. It may appear as the element that restrain or partially limit other elements; however, it can be infiltrated to some extent. Natural and built edges exist from small to large scales in the cities. In terms of entity, urban edges can be investigated objectively and

subjectively:

1. Objective: the objective or physical edges are categorized to natural and built edges.
2. Subjective: the subjective edges do not physically exist; however, they define a direction in citizens' minds and connect two parts of the city. For instance, the objective historical edges are included in this category. These edges lose their appearance or physics over time but create a collective memory in citizens' minds and their present existence is dependent on their past subjective presence. City walls and moats that have disappeared in the current cities and define a direction are the examples of this kind of edge (Yarahmadi, 2010).

Various types of historical edges (Bazzar, government citadels and towers, etc.), urban edges (highways, etc.) and natural edges are discussed in different articles and this paper refer to the latter one.

Natural urban edge

Natural urban edge is created as a result of overlaying on natural geographical features. a natural linear element that configures the city organization can be considered as a natural urban edge when. is involved in the organization of city space, it can perform as a natural urban edge. In addition to the influence the natural urban edge has on the image of the city, it can perform as a

Analyzing the Effects of Urban Edge Overlay on Natural Coastal Features in Cities of India

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Abstract

Edges are one of the five elements involved in the image of the city. Edges are linear elements with generally extroverted functions which define a border between two sections. These elements may be defined by built elements or may be located on natural geographic features. This paper analyses the special functional features of urban edges that are located on natural coastal features. It is considered that natural urban edges that are created as a result of overlaying on natural features can be functionally considered as a public space in the city. Urban edges also affect the image of the city directly. But how can these kinds of urban edges perform in configuring city structure subjectively and objectively? The geographical domain of this research is the cities of India. Therefore, three case studies were investigated in India in order to answer the research question. Ganga River in Varanasi city, the edge of Pushkar Lake and Mumbai seashore are the three cases where the urban edges overlay the natural feature of the shore. Discussing these three cases reflect how commercial functions, creation of ritual space, formation of public space, people presence and public interaction along the shoreline can be concluded as a result of urban edge overlay on natural features.

Keywords

Edge, City, Social interactions, India, Varanasi, Mumbai, Pushkar