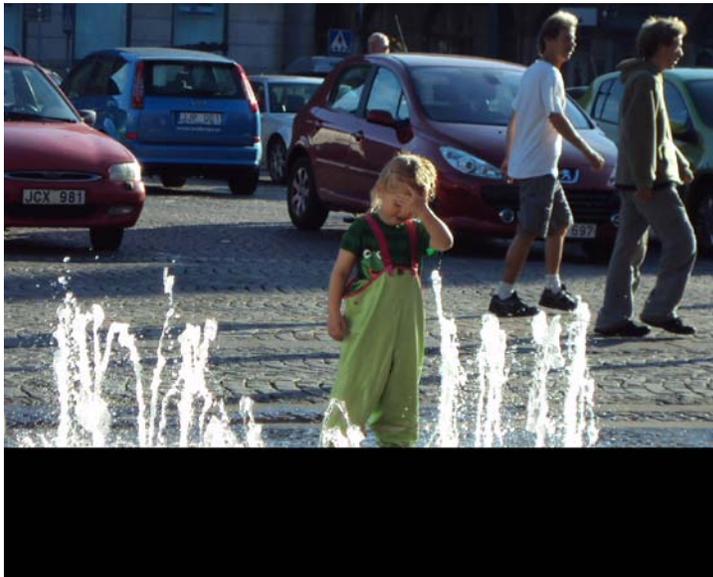




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# THE ROLE OF WATER AS A RESTORATIVE COMPONENT IN SMALL URBAN SPACES

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The Role of Water as a Restorative Component in Small Urban Spaces

Vattnets Roll Som Restorativ Komponent på Små Urbana Platser

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## **Abstract**

Modernization and urbanization has its share of dire consequences, mainly stress related problems which has been on rise all over the world. Intense densification has made cities devoid of open spaces. Nevertheless, the need of spaces with restorative potentials is much felt in order to mitigate the stress related problems of the urbanites. Hence, the thesis is based on understanding the role of water or water features and its qualities in fostering psychological restoration in small urban environments.

Two types of studies— onsite observation (qualitative) and preference study (quantitative) was carried out to learn the importance of water or water features in the urban environment and to find the restorative qualities of water features. The qualitative observation which was carried out in the cities of Sweden and Nepal has help identify people's fondness for water, while the quantitative study has revealed qualitative parameters of water features which may aid restoration.

The results from both the studies indicate that water or water features in urban areas may foster restorative qualities of an environment. Hence, the knowledge reflected by the thesis can be referred as guidelines by architects, designers, planners and even policy makers to create or transform a place into a power place that supports psychological restoration which in both short and long term will benefit public health and overall wellbeing of the city dwellers.



# 1.

## Introduction

For ‘grown-ups’ it is considered indecent and immodest jumping, dancing and rolling on the grass as if inflicted with insanity, but it’s a true story, not of insanity but of euphoria induced by nature. I and my friends realized the immense power of nature during experiencing this place called Sundari Danda, a green hillock in Pokhara, Nepal, which offers magnificent views of two lakes—Rupa and Begnas. The splendid view of the lakes elicited a positive change in the mood, energy and behavior. We felt completely rejuvenated and elated.

Such an experience is very rare in my life as I live in a very dense city—Kathmandu—where every form of nature and open spaces have been replaced by buildings and other urban infrastructures. The modern lifestyle is equally responsible for less time I spent outdoors. Hence, the opportunity to get in touch with such wonderful natural environments is extremely reduced.

I spent most of my childhood in a small city in southern region of Nepal. The city lacked a public space in the form of squares or plazas or even parks. The only place where people took a recess or spend their leisure time was at the banks of a river nearby called ‘Narayani’. I and my family also frequently used to spend time on the bank which was both sandy and grassy. The sense of refreshment that I used to feel during and after spending sometime on that place still lingers in my mind. Since childhood, I have noticed the positive affiliation of water and people. I have seen how even a small fountain or a cascade successfully sparks interest amongst people.

Water is the most important life sustaining element after air or oxygen. Water also has wide range of utilitarian value such as washing, cleaning, bathing, cooking etc. It also offers recreational values. The importance of water to human beings and other living beings is quite apparent. Apart from its life sustaining and utilitarian values, humans are also fascinated by its aesthetic beauty—Water has been important part of gardens and public spaces throughout the history (see for e.g. Lehrman, 1980; Burmil et al., 1999; Dalley, 1993). Also, more often people are seen picnicking in a venue some place near water. People are very often seen spending their leisure time resting on the beaches, and near lakesides, riversides or simply closer to a small pond. Hence it seems, people are intuitively attracted to water and shares a special bond with it.

My experiences and curiosities regarding water as an aesthetic element in a landscape have generated a base for this thesis. And my intension of creating 'small happy places' amidst the urban densification, that can attract urbanites to take a recess from their mundane lifestyle, has put up the much needed fuel for the study.

### **1.1 Background/problem description**

With rapid urbanization, cities are developing and getting denser. Every open space is hence being occupied to erect buildings and other such urban infrastructures. This has reduced possibilities of creating interactive outdoor settings where people can spend time to rest or socialize. The lack of open spaces has further reduced the possibilities of getting engaged with nature. Such a purely artificial environment lacking nature can have deleterious consequences (Desjarlais et al., 1995). Also, with the invention of televisions, computers, internet, mobiles and other such form of modern electronic gadgets, people are spending more time indoors. In addition to this, the city environments consist of many other forms of stressors like too much crowding, demanding lifestyles, chaos, noise etc. These negative urban features could lead to stress or mental fatigue (Kaplan and Kaplan, 1989; Kaplan, 1995; Ulrich et al. 1991; Van den Berg et al., 2007). Stress further can lead to many health anomalies (Herrman et al., 2005; Raphael et al., 2005). It can impair mood (DeLongis et al., 1988), efficiency (Brand et al., 2000), decrease concentration power (Kaplan, 1995). It is thus not surprising that stress and stress related illnesses have been burgeoning all around the world (American Institute of stress, 2002; World Health Report, 2001).

Hence, it has been important to provide environments that ameliorate stress and mental fatigue such that to create a healthy and happy urban community. In cities with dense population, larger demand for housing, employment, education, recreation etc. causes the growth of built infrastructures mainly buildings and roads. Open spaces are to its minimum or are limited in such cities. Few such open spaces in the form of public squares or plazas also could lack the much needed restorative features. Hence, Strategic planning and design is required to create restorative settings in the available small spaces or to transform the environment of present public places into restorative settings. For this, proper understanding of restorative components is required.

### **1.2 Objective**

The power of nature has been well discussed and demonstrated by large bodies of studies. However, the major focus of these studies has been limited to vegetation. But, with the thesis I

have put an effort to apprehend the role of water as a restorative component in urban spaces. This should not necessarily mean that water is presented or studied here as an alternative restorative component for the replacement of vegetation or other natural features. In fact, water is studied and promoted as a complimentary element so as to holistically form a restorative environment.

Studies which have mentioned water, discusses merely the affects of its absence or presence. The handful of studies focusing explicitly on investigating the positive features of water are broad and vague .Moreover, many of those studies have tried to explore the preferred qualities of natural water bodies in the natural environment and very less in urban environments or as urban features. The thesis, therefore, puts an effort to fill the void and contribute to the knowledge in this category.

While designing or planning a place with water, Planners and designers often use their intuition which often could go wrong. A scientific reference could provide them with a good guidance for achieving a design that can foster mood, behavior and overall well-being. It is true that design is very site-specific or guided by the nature and demands of the sites. And also, design is never '2+2=4'. Nevertheless, a good reference can act as both qualitative and quantitative guide in achieving a sound design or environment. Thus, the thesis could be considered as an effort to provide meaningful suggestions for professionals while working with urban environment constituting water.

The three aims of the thesis are:

1. To review the literature and discuss the role of water as a restorative component.
2. To test and analyze the theories, assumptions and hypotheses related to water and restoration.
3. To provide basic suggestions for design and planning of urban water features especially in small spaces.

### **1.3 Methods**

Firstly, extensive literature review was carried out. It was done in 2 phases: General and water specific. The general review consisted of literature related to stress, restoration and nature, where water was considered as a part of nature. This was expected to provide general ideas about stress

mechanism (stress, its causes and mitigation); psychological restoration; and about the restorative power of nature mainly including water. The review also aimed at acquiring knowledge regarding the effects of urban and built environment. The water specific review focused on the literature that relates water features and restoration or restorative qualities. The main intention was to learn and understand the restorative qualities of water. Then, two types of studies— onsite observation (qualitative) and preference study (quantitative) was carried out. The main purpose of qualitative study is to learn the importance of water or water features in the urban environment and that of the quantitative study is to find the restorative qualities of water features. But, both the studies are complimentary support to each other forming a holistic result. The observation study was carried out in both the cities of Nepal and Sweden. While, the preference study in Nepal was conducted amongst the local people.

For the observational study, the particular areas in both the countries were chosen on the basis of their easy accessibility with respect to time, distance and economical factors. The main concern during selection of areas was to include both the similarities and variations in terms of the environment offered by the water features or its physical features so as to compare and analyze the results or the observations. The study majorly included observation of moods and behaviors (including activities) of people present near or around the water features.

For the preference study, 71 color images were selected strategically from two hundred images depicting urban scenes dominated by water features from the internet. The selection of photographs was made to include the suggested predictor variables: Perceived water quantity, the degree of naturalness, contrast, and reflectivity. The 50 participants were asked to rate each image on the scale of 1 to 5 (where 1 means lowest preference and 5 means highest preference) based on their own personal preference or upon how good they might likely feel within such an environment or place.

## 2.

# Stress, restoration and nature

### 2.1 Stress and its effects

According to Ulrich (1991), stress is an adaptive process of responding to a challenging or threatening situation. The psychological reactions (fear, dislike, and attention/interest) cause physiological changes (raised blood pressure, heart rate and muscle tension) so as to prepare the body for dealing with the situation (either fighting or fleeing).

Hence, stress could be understood as a natural reaction which our ancestors used for their survival. Though today, the sources or the factors of eliciting stress have changed, but our body reacts the same way. Due to the nature of the stressors today, we don't or can't respond to it by fleeing or fighting. According to American Institute of Stress (2002), if such untreated reactions are invoked frequently, it may contribute to hypertension, strokes, heart attacks, diabetes, ulcers, neck or low back pain and other maladies. S.Kaplan (1995) mentions that stress not only has physiological and experiential consequences, but that it has extensive impacts on performance as well.

The evidence relating stress and physical health has been increasing (Herrman et al., 2005; also see for e.g. Raphael et al., 2005). Stress can negatively affect short-term memory processing, systolic blood pressure and heart rate (Brand et al., 2000). Environmental stressors (e.g. crowding, community noise, air pollution) can elicit substantial stress in large groups of people (Ulrich et al.1991).It can further induce anxiety related disorders (Grinde, 2005). Stress also can be accounted for increased crime, violence and other threats to personal safety; pernicious peer pressures that lead to substance abuse and other unhealthy life style habits; social isolation and loneliness; the erosion of family and religious values and ties(American Institute of Stress, 2002).

### 2.2 Restoration

Hartig(2007,pg.164) defines restoration as 'the process of recovering physiological, psychological and social resources that have become diminished in efforts to meet the demands of everyday life'. There are basically two major theories related to restorative environments: Psycho-evolutionary

Theory forwarded by Roger Ulrich (Ulrich, 1991) and Attention Restoration Theory by Stephen Kaplan and Rachel Kaplan (Kaplan and Kaplan, 1989).

### **2.2.1 Psycho-evolutionary Theory**

According to Ulrich (1991), 'restoration' pertains to recovery influences that extend to the anabolic recharge of energy expended in the psychophysiological mobilization involved in responding to a stressor. It involves numerous positive changes in psychological states, physiological systems, in cognitive functioning or performance and also in emotional states. Such positive reactions or changes can be elicited by unthreatening natural contents mainly vegetation and water.

### **2.2.2 Attention Restoration Theory**

This theory is developed by Stephen Kaplan and Rachel Kaplan (1989) according to which there are two kinds of attention: directed and involuntary also called 'soft fascination'. Directed attention is brain's inhibitory attention mechanism, which handle incoming distractions while maintaining focus on a specific task. Inhibiting distractions while trying to focus on the particular task require effort. This effort effects directed attention, resulting in mental fatigue or losing one's ability to concentrate. Kaplan and Kaplan suggest that a setting which is less demanding or which requires involuntary attention can help recover an individual from the state of mental fatigue.

### **2.3 The need to integrate nature in the city environment**

There are several studies which have demonstrated the positive effects of nature— fostering mood, behavior or emotional states (Ulrich, 1981; Hartig et al., 2003) and improving efficiency or concentration power (Van den Berg et al., 2003; Ottosson and Grahn, 2005). Studies also have shown the restorative power of the natural environment (Ulrich, 1986; Ulrich et al., 1991; Hartig et al., 1991; Parsons et al., 1998; Grahn & Stigsdotter, 2003; Stigsdotter & Grahn, 2004). Urban environments lacking nature are associated with negative responses and results— In an experiment by Ulrich (1979), mildly stressed subjects were shown color slides of either everyday nature scenes dominated by trees and other vegetation, or 'unblighted' American city views lacking vegetation. The individuals rated their feelings immediately before and after the slide presentations using a standard affect questionnaire. The results showed exposure to the vegetation views significantly reduced feelings of fear, and positive effects such as affection and elation were

increased. By contrast, the urban stimuli actually aggravated anxiety on some dimensions, particularly in terms of increased feelings of sadness.

Studies have also suggested that urban environments can aggravate aggression and violence, resulting in many instances of crime (Kuo and Sullivan, 2001). Many studies have shown higher positive responses or preference for natural environments than for urban or built environments specially those lacking nature (Ulrich, 1981, 1986, 1991; Kaplan and Kaplan, 1989; Hartig, 1993; Parssons et al., 1998). It can hence be concluded that a natural setting is likely to promote restoration while the urban built environment lacking nature may fail to do so.

So, why is nature or natural environment associated with more positive responses? Regarding this Ulrich (1993, pg.89) states, 'It is suggested that humans have a partly genetic predisposition to readily acquire and then persistently retain liking/attention/approach responses to natural elements and configures that favored survival because they were associated with primary necessities such as food, water and security.'

Kaplan (1995) outlines that a natural setting is likely to promote restoration because it affords the four integral components that help foster restoration: being away; fascination; extent; and compatibility.

Human beings are rapidly heading towards ultra-modernization and the deleterious effects it renders in the environment and thus in the inhabitants of this modern world, are its by-products. Modern society has to constantly deal with the repercussions such as pollution, crowd, traffic congestion, demanding lifestyle etc. Such negative factors may contribute to stress (Ulrich et al. 1991; Desjarlais et al., 1995; Van den Berg et al. 2007). Furthermore, stress can impair mood, efficiency, health and overall well being (Grahn and Stigsdotter, 2003; Herrman et al., 2005; Raphael et al., 2005).

Ottosson (2007, pg.16) mentions:

*In artificial environments, we are forced to use our cognition and logic... When we are asked to do something new, unpleasant or exacting in purely artificial settings, this immediately arouses feelings of insecurity and stress, which give rise to a number of physiological responses called "fight and flight reactions" .*

Urban environment could contain too much of artificial stimulation and spending time in such environments may cause exhaustion and produce a loss of vitality and health (Maller et al., 2005). Today cities grow or are developed on the expenses of natural spaces. Such a disengagement with nature, as Grinde (2005) suggest, can aggravate anxiety related disorders due to the ‘discord’ between the present way of life and what our genes are adapted to. Research has suggested that providing an access to nature in an urban or built environment can be beneficial as it may foster health and provide restoration from stress (Kaplan and Kaplan, 1989; Grahn and Stigsdotter, 2003; Stigsdotter, 2005).

Instances of nature in a city might be beneficial not only to the direct on-site users but also to the people living or working in the surroundings. Tennessen and Cimprich (1995) found natural views (majorly containing trees and water) from dormitory windows were associated with better performance on attentional measures of the students. A study conducted at six low-rise apartment communities by R.Kaplan (2001) outlines that having natural elements or settings in the view from the window contributes to the residents’ satisfaction with their neighborhood and with diverse aspects of their sense of well-being.

Many examples provided above suggest that natural environments are better than the built environments. However, the thesis does not intend to discourage urban development but promotes the idea of integrating or incorporating natural elements in the urban setting such that to help the inhabitants to overcome urban ills such as stress, mental fatigue and various other anomalies. Furthermore, with the understanding of nature’s powers, the thesis intends to promote and support the idea of nature in an urban environment with a focus in one of its major component—water.

#### **2.4 Linkage between Preference and restoration**

Environmental Preference as the Kaplans(1989) defined is an expression of underlying human needs. They have also outlined that humans are more likely to prefer a setting where they can thrive and function effectively. Appleton (1975) suggests that human landscape responses are in part inborn and derive from basic biological requirements for survival similar positive relation between preference and restoration is discussed and demonstrated by many scholars (Ulrich, 1986; Korpela and Hartig, 1996; Hartig et al., 1998; Purcell et al., 2001). In a study (Herzog and Bosley, 1992) independent groups of altogether 341 undergraduate students rated 66 color slides of natural settings for the target variables—tranquility, which was defined as ‘how much you think this environment would encourage relaxation, peace of mind, escape from the strains of living’; and

preference, which was defined as 'how much you like the environment depicted, for whatever reason'. The result showed high degree of overlap between these two variables.

In another such experimental study, Van den Berg et al. (2000) tested the mediating role of restoration in environmental preferences. Participants were shown a video of either a natural or a built environment after a frightening movie. Participants' mood ratings were assessed before and after both the shows. Participants also rated the beauty of the environment shown and performed a test of concentration after viewing the environmental video. The results indicated that participants perceived the natural environments as more beautiful than the built environments. Also, viewing natural environments improved mood and concentration of the participants than viewing built environments. This reveals the relation between positive responses towards potential restorative environment.

Many evidences have suggested that natural environment is more preferred than built environment (Ulrich, 1986; Kaplan and Kaplan, 1989; Hartig, 1993). Similarly, the natural environment has been found to have more potential for restoration than built environment (Ulrich, 1981; Ulrich et al. 1991; Ottoson and Grahn, 2005; Hartig et al., 1991). This correlation also indicates that preference and restoration is quite related.

### 3.

## Water and its qualities

*“It can be an ocean, a big lake, a small lake, river, stream, or pond; it might be placid or fast-moving, tranquil or falling, with trees reflected or with rapids. Water is a highly priced element in the landscape.”*

- kaplan and kaplan, 1989, pg.9

There are very few empirical evidences that have explicitly proved the restorative benefits of water, nonetheless it cannot be denied that physical contact (being under shower, immersing in the bathtub or Jacuzzi, swimming, or simply dangling one’s feet in the water) or even the sight of water can evoke a sense of joy and bring about a complete rejuvenation— the reason why we choose a place or setting with waterscapes for a picnic or for the entire vacation. This tells how humans are intuitively attracted to water. In this section of the Thesis, I will explore, review and analyze the theories and findings that relate water, human psyche and restoration.

### 3.1 Water as an aesthetic element

If one turns the pages of history, one can find abundant evidences of water being used for aesthetic pleasure, in gardens or public plazas—for e.g.in Mesopotamian gardens(Dalley, 1993; Burmil et al.1999), Egyptian gardens(Burmil et al.,1999) Chinese gardens(Keswik,1978) etc. Medieval monastic gardens and renaissance gardens also had centrally located water themes (Stigsdotter, 2005). Many historic squares and plazas consist of a water feature as a vital attraction (for e.g. Victoria Square, Birmingham; Trevi square, Rome, Italy; Piazza Navona, Rome, Italy). One of the most common and vital content in many of world’s most famous public places is a water feature (for e.g. Millennium Park in Chicago, USA; Versailles Garden, Versailles, France; Dundas Square, Toronto; Trafalgar Square, London, UK). Beauty and popularity of many cities are based on water, for instance, waterfront cities like Stockholm, Venice, Helsinki etc. (PPS, 1999). Waterfront places are also amongst most successful and attractive public spaces (see for e.g. Helsinki Market Square Helsinki, Finland; Nyhavn and Kongens Nytorv Square, Copenhagen, Denmark; Paris Plage, Paris, France etc.).

In many popular examples of architecture and landscape architecture, water is seen to foster the aesthetic values of overall design ( for e.g. Taj Mahal, Agra ; Angkor Wat, Cambodia; Louvre Museum, Paris; Bellagio, Las Vegas; Fallingwater House, Pennsylvania; Barcelona Pavillion, Barcelona; Hyde Park, London; Central Park, New York; Golden Gate Park, San Francisco; Beihai Park, Beijing; Ueno Park, Tokyo etc.). This suggests that people have been tantalized by the aesthetic values of water all the time since ancient age till today.

### 3.2 Symbolic meaning/value of water

Water, in many cultures is revered. In Hindu culture, water is associated with holiness, a sacred element that can cleanse and purify your body and soul. Hindus believe that by simply taking a dip in holy rivers like Ganges one can get redemption from all the sins committed. Water is also used as a sacred element in their traditional rituals. They also believe, sprinkling holy water (called ‘jal’) in the living spaces and one’s surroundings help to drive away evil and negative forces. Drinking such ‘jal’ is believed to foster health and vitality. Similarly, in religions like Christianity, Judaism and Islam, water is associated literally and symbolically with significant events in human life— baptism (in Christianity), immersion of the body in a water pool before marriage (Judaism and Islam), and purification of the dead body before burial (Burmil et al., 1999). Water and Water bodies in many cultural festivals have significant roles—in Kathmandu, a famous festival generally called as ‘Hadigaon ko jatra’ is celebrated in a traditional pond where devotees look for an ornament belonging to a god which as a myth is believed to have been lost in the same place.



**Image.** Photo exhibiting celebration of a traditional festival ‘Hadigaon ko Jatra’, Hadigaon, Kathmandu, Nepal ( source: romex\_romex).

Similarly, in 'Ganesh Chaturthi', a popular festival celebrated in India, the statues of lord Ganesha is eventually immersed in a river or a sea following a traditional procession. The ritual of eventual immersion of the statue in the water is believed to take away all the misfortunes of the devotees. The association of water as 'god-like' element in many cultures conveys a sense of acknowledgement of the power that water possess. Water is also considered as a healing element, both materialistically and psychologically. Johan Ottoson (2007) mentions in his introspective study that the sight and sound of water used to evoke a sense of security during the period of rehabilitation from his brain injury. He further suggests that inert objects like stone and water could play a calming role during healing process. Many water related therapies (spring bath, floatation therapy, hydrotherapy, etc.) also connotes its power.

### **3.3 View of water**

Bourassa et al. (2003) conducted an empirical analysis of the impact of a view on residential property values using a database of nearly 5,000 sales in Auckland, New Zealand. They found that wide views of water add an average of 59% to the value of a waterfront property, but that this effect diminishes quite rapidly as the distance from the coast increases. In another similar study in Washington, Benson et al. (1998) found that the view of an ocean or a lake adds a large value to a property (more than double for the highest quality views). They also noticed that the value of the property decreases as the distance from the water source increases. Similar other such findings (see for e.g. Bond, Seiler and Seiler, 2002) are suggestive of the fact that water is perceived as a very pleasing element and hence could play a role in psychological restoration.

### **3.4 Water, preference and restoration**

Many literatures have mentioned water as a positive factor in the landscape; it has been associated with positive responses and restoration likelihood (Ulrich, 1983; Kaplan and Kaplan, 1989; Ulrich et al., 1991; Nasar and Li, 2004; Berto, 2005; Nordh et al., 2009; Völker and Kistemann, 2011). Water as a preferred landscape feature was mentioned significantly by visitors interviewed in the urban reserve that is located 2 km from downtown Buenos Aires (Fagi et al., 2011). Karmanov and Hamel (2008), after an empirical study, concluded that presence of water in the urban environment may play a restorative role.

White et al. (2010) found that built environments with water were preferred as much as natural environments without water. Their study suggests that both natural and built scenes containing water were associated with high preferences, greater positive affect and higher perceived restorativeness than those without water.

Examples of studies measuring physiological changes to investigate restorative effects of a setting with water could rarely be found. One such rare study performed in Sweden included physiological measures as a basis of investigation, the subjects were presented with color slides comprising of any of the 3 categories: Nature dominated by trees and other vegetation; nature with water; or urban settings without vegetation or water. Results from self ratings indicated that exposure to the two categories of natural scenes, especially water, had more positive influences on subjects' emotional states. Recordings of brain electrical activity revealed that alpha-wave amplitudes were significantly higher when the subjects viewed trees and other vegetation as opposed to urban scenes, and tended to be higher during the water rather than the urban presentations (Ulrich, 1981). Ulrich further suggests that natural settings, such as the water and forest settings, might elicit a parasympathetically dominated response similar to a mild, eyes-open form of 'relaxation response' or wakeful, meditation-like state (Ulrich, 1981; Ulrich et al. 1991).

Ruso & Atzwanger (2003) tested the effectiveness of water on human psyche—they installed a fountain in a corridor of a shopping mall and filmed the scene with a hidden camera. After several recording sessions they changed the setting by emptying the fountain and filming the scene without water. In the course of three months they collected and analyzed behavioral responses of the subjects. They found that if the fountain is filled with water, duration of stay of the passers-by on the 52m<sup>2</sup> areas in question increases by 21.4 % and they prefer to stay closer to the fountain. They also were more likely to explore their environment and to interact with each other. The experiment indicates that water in a setting can affect the behavioral pattern and the way how the space is used.

The number of studies mentioned above promotes a positive association of water and restoration likelihood. But, the question now arises— why do humans have such a positive responses towards water? Or why water settings are effective in producing restoration? Yet, there is no straight forward answer to this. It's possibly because water is linked with aspects of living— a life giving or life sustaining element; utility (washing, cleaning); recreation (boating, rafting, swimming,

etc.); cultural values etc. Or, it might probably have evolutionary roots as argued by Ulrich (1993); Appleton (1975); Kaplan and Kaplan (1989); Coss and Moore (1990).

Ulrich (1993, pg.90), in his literature states:

*“A functional-evolutionary perspective further implies that people should respond positively to natural settings having water and spatial openness. There is considerable evidence from excavations in east Africa that even early hominids often located their camps at the edge of water (Leakey 1980; Brown et al. 1985).The survival- related advantages would have included immediate availability of drinking water, security and defense advantages, attraction of animals that could be hunted, and in some locations (seacoast, estuary, salmon river) extremely high food productivity associated with fish, shellfish, and crustaceans.”*

Coss and Moore (1990) argues that during evolution, ability to find drinking water has probably acted as a major source of selection, failing to do so would have reduced the possibility of survival. Similarly, the positive relation between water and human psyche has been explained as a result of ‘hydrostrategic attribute’ by Wagner (2003, pg.2):

*“Humans are strongly tied to water and our bodies show a number of hydrostrategic attributes—both psychological and physiological—for interacting and dealing with water. We value living near water, derive pleasure and even health benefits from viewing water scenes, and seek out water areas for recreation. Compared to other terrestrial mammals, humans are exceptionally thirsty and have physiological mechanisms useful for interacting with water such as subcutaneous adiposity and the diving reflex. Intriguingly, our health is critically dependent on dietary sources of essential fatty acids, which are predominantly found in water environments.”*

Few studies have however found that presence of water doesn’t have a reliable influence on environmental preference or restoration (Van den Berg et al., 2003; Nordh, 2010). But, it is to be noted that Nordh (2010, pg.64) in her literature had maintained,

*“It might be that the type of water features in my images and in the conjoint alternatives represent too small amounts of water-covered area...”*

Similarly, Van den Berg et al. (2003, pg.145) have also mentioned,

*“... Our manipulation of the presence of water may have been too weak to have any impact on participants’ preferences or restoration from stress.”*

### **3.5 Restorative qualities of water or water features**

Herzog (1985) studied the preference for four categories of waterscapes: mountain waterscapes; swampy areas; rivers, lakes and ponds; and large bodies of water. The predictor variables used in the study were: identifiability ( a sense of familiarity); coherence( how well the scene “hangs together”); complexity( amount of information presented in an environment); texture( how fine-grained the surface is); spaciousness(openness); and mystery(possibility of obtaining more information).The result showed that the mountain lakes and rushing water are highly valued. Contrarily, swampy areas, especially stagnant creeks, were by far less preferred. The research also indicated that four predictor variables (spaciousness, coherence, texture and mystery) had significant impact on preference. The most preferred waterscapes were high in spaciousness, coherence and mystery, while low in texture.

In another similar study by Bulut et al. (2010), it was demonstrated through a visual quality survey that Waterfall Scenery was the most preferred waterscape, followed respectively by Lake Scenery, Mountain Lake Scenery, Landslide Lakes Scenery and River Scenery. And, amongst landscape parameters (vividness, harmony, fascination, naturalness and being interesting), fascination, being interesting and vividness have highly significant effect upon preference. It was also observed that visual preference point increased with the increases in points of vividness (vividness of the waterscape with light and colors), harmony (rhythm between natural and cultural landscape elements) ,fascinaty(fascination of landscape elements), naturalness(being natural of the landscape) and being interesting(challenging of the landscape).

The studies described above focused on waterscapes but in natural environment. For now, those results could be hypothesized being equally transferable to the urban environment. Nasar and Lin (2003), in a study, focused on evaluating the human responses for five categories of urban water features— Still, Flowing, Falling, Jet and Combination(flowing, falling and jet). The result suggests that Jet and Combination are highly preferred, and, falling and flowing are least preferred. The study also indicated that still water is more calming, and flowing water evokes feelings of excitement.

The studies related to waterscapes vary in their results. However, I have tried to access most commonly argued and suggested features. Several other qualities are pointed out by various scholars, which I will further list and describe below:

One of the most common characteristics discussed as important predictor of preference or restoration in a scene or landscape is ‘naturalness’ or how much a scene is natural in character. Many researchers have argued that the most preferred scenes are those with high degree of naturalness (Herzog et al., 1982; Ulrich, 1983; Zube et al., 1983; Kaplan and Kaplan, 1989; Smith et al., 1995; Hagerhall et al., 2004; Ivarsson and Hagerhall, 2008; Völker and Kistemann, 2011; Simonič, 2003; SEÇKİN, 2010). Lamb and Purcell (1990) define ‘naturalness’ in an environment in terms of proportion of coverage by vegetation, water and/or rocks.

The following factors could play important roles in making a scene with water feature look and feel more natural:

- *Presence of vegetation and greenery at the edges or on the immediate surrounding*  
Vegetated water edge enhances the water and its environment (Fairbrother, 1974; SIMONIČ, 2002; Steinwender et al., 2008; Le Lay et al.2008).
- *Presence of aquatic life (flora or fauna)*  
Though vegetation help to elevate the degree of naturalness, the presence of too much aquatic plants or wetland type vegetation has been considered negative (see for e.g. SIMONIČ, 2002; White et al., 2010). The presence of fishes in the water, have been positively associated with preference and stress reduction (Katcher et al., 1984; DeSchrive and Riddick, 1990).
- *The organic shape of the water edges*  
If we look at natural water features, it is never in perfect geometrical shapes; rather it is undefined, rustic and has organic forms. Water edge mimicking a natural form is desirable (SEÇKİN, 2010).In a landscape scene, a highly preferred scene consist of dominant visual contours or edges those are curvilinear or irregular rather than starkly rectilinear or regular (Ulrich, 1986). Grahn et al. (2007) found that one of the formally designed water feature present in Alnarp Rehabilitation Garden in Alnarp, Sweden, is the least preferred area amongst

the rehabilitating patients. Water features with much artificial impressions or interventions are less preferred (Steinwender et al., 2008; Le Lay et al.2008).

- *Motion or movement*

The animistic quality of water is its natural trait. Movement is one of the interesting qualities of water and is associated with positive responses (Mador, 2008; Ulrich 2008; SEÇKİN 2010; also, see for eg. Herzog, 1985; Nasar and Lin, 2003; Bulut et al., 2010). However, rough or intense motion of water may be associated with risk or danger.

- *sound of water*

Sound of water has been positively associated with preference and restoration (Mador, 2008; Alvarsson et al., 2010; SEÇKİN, 2010)

Quantity/amount/proportion or percent of water surface present in a scene also affects the perception of it and of overall environment; large bodies or higher proportion of water are positively responded (Herzog, 1985; Brown and Daniel, 1991; McAndrew, 1993; Yamashita, 2002; Steinwender et al., 2008; Le Lay et al.2008; SEÇKİN, 2010; White et. al, 2010). Open view (openness) or spacious quality that the large bodies of water offer is probably its qualitative feature (Herzog, 1985; SEÇKİN, 2010) and is associated with higher tranquility (Herzog and Bosley, 1992). White et al. (2010) examined possible ‘dose-response relationships’— by adding and increasing the amount of water in natural scenes result in more favorable ratings, however in built environment they found that increasing the proportions had no further effect. The large bodies of water gives higher landscape value probably because it affords important survival function (Kaplan and Kaplan, 1989).

The other positive and interesting qualities of water are contrast (Whyte, 1980; Völker and Kistemann, 2011); and reflectivity (Nasar and Li, 2002; Yamashita, 2002). Contrast is probably one important trait; the plasticity and animistic qualities that the water possesses help creates contrast with the built environment which is mostly stiff, hard and harsh. It is also evident from the nature that its fascinating designs always is a combination or visual balance of hard and soft, for e.g. rocky mountains and snow; wooden branches and leaves; rivers and stones etc., therefore it can be argued that this perceptual visual balance could play an important factor in the fondness of urban waterscapes.

Reflectivity of water is also associated with positive responses. Nasar and Li(2002) examined human preference for water and its reflection by comparing responses to reflection versus transparency. The analysis revealed that people gave the most favorable ratings to the scene with reflective water.

### **3.6 Perceived water quantity**

During my architectural practices, I have noticed that perception of an environment or setting changes with respect to the features of the elements present or used in that environment. For instance, type of color, light, texture, pattern and material used in a room play important roles in perception regarding its size and even thermal aspects. For example, if a small room is painted with white or lighter shades of various colors, it appears to be or is perceived bigger and spacious than its actual size. Similarly, the room appears smaller if the wall or floor finishes are rougher or have denser/complex texture. This means that lighter hues or shades of colors and smooth textures softens or lessens the visual density of an element, hence making an environment look spacious and larger.

Regarding water as well, I have noticed that not only the surface area can impact perception of its amount or the quantity but also its color, depth visibility, texture, sound and even its animistic qualities. For instance, darker shades of colors can make water look denser also making its base invisible, hence it is perceived to be high in amount. For another instance, the perception of the amount of water increases if the texture of its surface increases. The intensity of sound and the motion of the water can also impact perception—the more the sound or motion, denser the water seems or is felt.

## 4.

### **Empirical studies**

Two types of studies— onsite observation (qualitative) and preference study (quantitative) was carried out to fulfill the objectives of the thesis i.e. to learn the importance of water or water features in the urban environment and to find the restorative qualities of water features. The main purpose of qualitative study is to fulfill the former objective and that of the quantitative study is to fulfill the latter one. But, both the studies are complimentary support to each other forming a holistic result. The studies also intend to examine the hypotheses presented and discussed earlier related to water and restoration.

Specifically, on-site observational study focuses on revealing following queries and testing the hypotheses regarding water and restoration:

- ✓ Is presence of people denser towards the closer proximity of the water feature?  
This is to understand if water in the environment can be powerful enough to attract larger number of people than other spaces within the same place. More people might mean more restorative qualities the environment possesses.
- ✓ What are the major activities of the visitors?  
It is to learn what activities are stimulated or facilitated by water or an environment with water. Calm, quiet and peaceful behaviors might indicate relaxation.
- ✓ Do the users look relaxed or happy?  
Frequent smiles, laughter, bright and relaxed facial expression, positive body language and attitude may hint good mood.
- ✓ How long do people usually stay?  
People are likely to linger for a longer time if the environment is restorative.
- ✓ Are people usually in a group or alone?  
It can be assumed that people who are there all by themselves mostly have a motive of relaxing their mind and body.
- ✓ Does certain age group or gender seem particularly fond of water?
  
- ✓ Does presence of fishes in the water makes a difference?

The differences in the user's responses, behaviors and activities are sought in the water body with and without fishes. It is hypothesized that fishes adds attraction and natural values to the water.

- ✓ Does animistic quality of water effects the ambience of overall environment?

It is to reveal the feel of the environment when water is aided by movement and sound.

As discussed earlier, it is assumed that movement and sound of water may add restorative values in an environment.

As major studies in the field of environmental psychology is based on western cultures (Ulrich, 1993), very few studies have been carried out in Asian and African part of the world. Hence, an attempt has been made for the hypotheses testing with the aid of observational study in a country with extremely contrasting culture and economic status. The observation study is intentionally carried out in two different countries – Sweden and Nepal— both contrasting in many aspects like culture, economy, geographic location, system, language, development etc. Hence, an understanding is sought between the similarities and differences with respect to preference based on these factors. The qualitative study also is intended to compliment observational study which has its limitation with respect to time and number of places under study.

There is a lack of literatures which provides details on restorative qualities of water features. Few studies forwarding such characteristics are also vague and insufficient. It is very difficult to plan and design urban waterscapes or features that promotes health and restoration on the basis of such small amount of recommendations available. There is the utmost need for more studies and empirical verifications regarding water features and its restorative qualities such that it could provide a good guidance for designers and planners to not merely decide upon adding water or not but also to use water strategically in the overall design and planning of urban areas such that it could benefit the users.

Thus, the preference study intends to understand most preferred environment featuring water and examine specific qualities of water or water features that is associated with 'feeling good' or restoration. As discussed earlier, following predictor variables will be compared and analyzed:

- ✓ Perceived water quantity
- ✓ The degree of naturalness
- ✓ Contrast

✓ Reflectivity

## **4.1 Observational study**

### **4.1.1 Procedure and measures**

The observational study was carried out on sites in the major public plazas, squares, parks containing various types of water features in the cities— Malmö and Lund— in Sweden, and in the cities— Kathmandu, Lalitpur and Bhaktapur—in Nepal. In Malmö, the sites for observation were various spaces in and around a place called Gustav Adolf's Torg. The particular area and its surroundings were chosen as it featured a large variety of environments with water features. Also, it was also a commercial district where the flow of people is expected to be more. Altogether nine different settings with water were observed. Basically, there were three kind of water features present in the area under observation— water canal, fountains (without pool or small basin), pools (with fountains). In Lund, eight different settings with water, in and around the area of the central train station were studied. There were altogether three varieties of water features presented in the places under study— natural looking ponds, pools with fountain, and fountain without basin (mild jets). In Nepal, observations were carried out in the following places: Garden of Dreams, Keshar Mahal, Kathmandu; Balaju Water Park, Balaju, Kathmandu; Nag Pokhari, Naxal, Kathmandu; Central Zoo, Jawalakhel, Lalitpur; Patan Durbar Square, Lalitpur; Pimbahal Pokhari, Pimbahal, Lalitpur; Siddha Pokhari, Bhaktapur. Garden of Dreams at Keshar Mahal and Balaju Water Park in Balaju, consisted of majorly three varieties of water features in several quantities— cascade, pools (with or without fountain) and fountains (with small basins only). The other places mostly consisted of a historical pond. Water feature in the Central Zoo was a natural looking pond. The selection of these places was mostly based on the availability and accessibility within the given time frame (mid of December to mid of January).

The places under observation were visited several times mostly when the climatic condition was comfortable and on weekends when large number of people were expected. The observation time usually ranged from 1 to 2 hours. The places were selected strategically such as altogether it contained variation in its qualities like: Size (big and small); moving and still; sound of water; reflectivity; the presence and absence of fishes; the design of water feature etc. The sites in Sweden were visited throughout October to November. The visiting time was usually between 12

noon to 1 p.m. when it's warmer than other time. In Nepal, the observation was done in throughout mid-December to mid- January.

On the site, following information was collected:

- ✓ Are there more people around to the closest proximity of the water features than other parts of the area?
- ✓ What are the major activities of the visitors?
- ✓ Do the users look relaxed or happy?
- ✓ How long do people usually stay?
- ✓ Are people usually in a group or alone?
- ✓ Do certain age groups or genders seem particularly fond of water?
- ✓ Does presence of fishes in the water makes a difference?
- ✓ Does animistic quality of water effects the ambience of overall environment?

#### **4.1.2 Analysis and result**

I have divided my results and analysis into general and water specific observations. General observation is mostly associated with overall or holistic environment comprising water and other elements, while specific observation is associated directly to water or water features.

##### **4.1.2.1 General observation**

During the observation, it is found that people like to stay closer to water if sitting opportunities are available. If there are spaces to comfortably sit, people seem to like sitting near water, comparative to similar areas without water. The seating availability could be a formal presence of furniture or informal as the plinth on the edge of water. Even grassy ground cover (dry) around the water feature could facilitate in attracting a number of people as it provides an opportunity to rest.



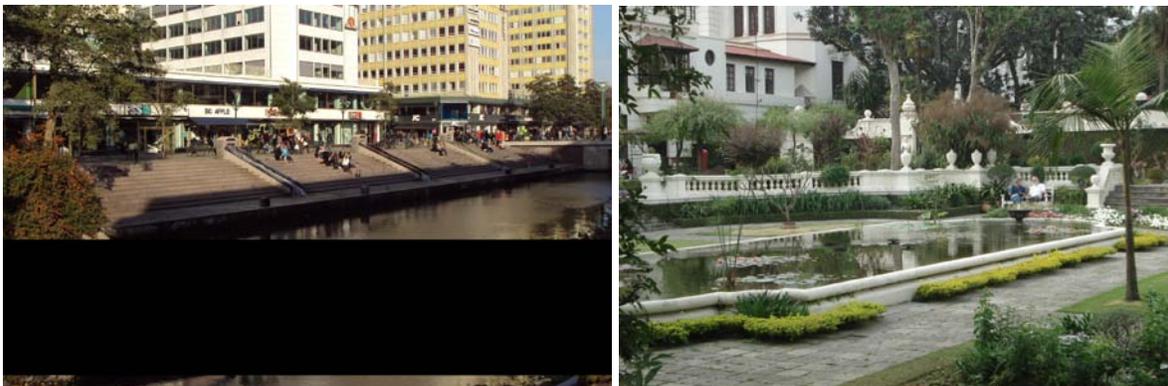
The major activities observed and assumed in relation to all types of water features is either resting and relaxing, or chatting. Other activities include eating, drinking, reading etc. People who are in group usually were found

*Image. Informal seating spaces—people sitting on the edge of a water feature and on the lawn, Kathmandu.*

having a light conversation (especially couples). Individuals who are alone usually sit peacefully either contemplating on some aspect of environment or closing their eyes. People in groups were also found eating or drinking. Socially unacceptable behaviors or activities (for e.g. as simple as loud conversation) were never observed in those places throughout the study. Facial expressions and overall behaviors showed signs of relaxation and calmness. The sight of smiles on the faces was frequent on the sites under study. Light conversations between people and the calm expressions on their faces while doing so could be interpreted as positive impact of the environment. These observations were common for both the Swedish and Nepalese sites.

The time people stayed on the sites usually varied from 15 minutes to more than 90 minutes. But it was observed that the reigning factor that is directly proportional to length of stay is thermal comfort. On the sites, it was also observed that there were more people in groups (two or more than two). They usually stop by for the purpose of resting, talking, or eating. The presence of females, especially groups of teenage girls were comparatively higher on the sites in Nepal. Young males, especially groups of teenagers, were present in small numbers. While, in Swedish sites, both the groups of teenagers (males and females) were almost absent. However, presence of old people on such sites is comparatively higher in Sweden. In the Nepalese sites, older people were present in very smaller numbers, more specifically; older women were less frequent than men.

One of the noticeable observations was the presence of large number of young people probably in their 20s and least presence of older people on the settings associated with the water canal in Malmö. Similarly, in Balaju Water Park in Kathmandu, it was worth observing that old people prefer staying away from any form of water features present within the site. The least presence of family groups near or around places with water features in Swedish sites was also a fact to be noted.



**Images:** *Most preferred settings- water canal at Malmo(left) and pond at Garden of Dreams, Kathmandu(right).*

#### 4.1.2.2 Specific observation

During the observation it was noted that passers-by stop much more frequently to look or take a picture if the site has water, as compared to sites containing only other elements. This was true in both countries and particularly noticeable if there was a fountain or the water contained fish.

In my entire observation both in Nepal and Sweden, I have found children getting hypnotically attracted to water. I have encountered many sights where children being carried by the elders, points towards water source as a gesture to take them near it. Children were found to be very curious about water— they all the time try to touch it or simply give a long gaze (as if they were literally hypnotized).



**Images.** *Children playing with water at garden of Dreams, Kathmandu (top left); in a square in Lund (top right); children dangling their legs in the pond at Balaju Water Park, Kathmandu, Nepal (bottom left).*

Fishes in the water was found to be a major attraction as evident from my observation. It adds life into water. A sense of naturalness is also added. Fish- gazing is fascinating. ‘Fish in the water’ is one powerful trait which can overshadow the lack of comfortable seating arrangements in a place. People don’t seem to mind standing for a long time to take the pleasure of watching the fishes. It

holds the people in the area for a longer time. Again, children were seen to be specifically fond of fishes both in the Nepalese and the Swedish context. In Balaju Water Park, it was notable to see people observing fishes in a pond through a meshed wire standing for considerable amount of time and also taking pictures. Similarly, in Siddhi Pokhari located in Bhaktapur, people were seen to derive joy from feeding the fishes.



**Image.** *Fish gazing- People don't mind standing a longer time to watch the fishes play, Balaju Water Park, Kathmandu.*

Motion of water was observed and felt as a special quality in the study. Motion provides water with sound. The sound of water was found to mask noises of traffic and crowd to a larger extent. In a few casual on-site interviews that I conducted in Malmö, 'water' and 'sound of water' was what the users mentioned when asked about most intriguing feature of that particular environment. It is worth noticing that the motion of water in the form of fountains, jets or waterfall also provided freshness in the air or the environment. The animistic qualities of water were found to bring life to an otherwise a dull place. Moving water can make a place look more 'happening' and interesting. In Pim Bahal Pokhari, a historical pond in Lalitpur, I noticed the difference between the environment when the water jet present there was in operation and not. The water which otherwise looked dirty and stagnant looked more fresh and appealing when the jets were in operation. Similar observations were also made in Patan Durbar Square and in Malmö— the movement of water aided by fountains or jets added freshness and appeal to the water and to the overall environment. Also, the sound produced by them was found to act as a white noise that

mitigated unpleasant sounds. The importance of animating small ponds was found to be more important as they usually get dirty and stagnant quickly without the aid of motion.



**Image.** *Fountain adding sound and freshness—the fountain was controllable by pressing a button; in Malmö.*

Another important observation concerns the reflectivity of water .In Nepal, It was noticed that water features that attracted most attention reflected nearby natural vegetation or the sky (for e.g. pools and ponds in Garden of Dreams and Balaju Water Park in Kathmandu). The least effective or unpopular places contained water reflecting urban elements like buildings (for e.g. Pimbahal Pokhari in Lalitpur). However, the issue of reflectivity was not clear in the Swedish sites.

The water features which attracted least interest were also the one which were small or those which covered less area. It was evident mostly in Garden of Dreams in Kathmandu, and in Gustav Adolf's Torg in Malmö as they contained several varieties of water features.



**Image.** *Examples of least preferred settings( characterized by less presence of people; in Lund(left) and in Kathmandu(right).*



**Image.** Example of least preferred setting, Pimbahal Pokhari, Lalitpur; The setting features large body of water, however, the setting is characterized by dominating built influences (which is also reflected in the surface of water), lack of vegetation and poor water quality (surficial foams and algae).

## **4.2 Preference study**

As discussed earlier, one of the objectives of the thesis is to make an attempt to find the qualities of urban water features which might help foster the restorative potential of overall environment. With this quantitative study, the hypotheses or the predictor variables derived from many related literatures and the observational study will be put to test, such as to check its efficacy and further validation. In the process, it is expected that other useful information will also rise to the surface.

### **4.2.1 Method**

#### **4.2.1.1 Preparatory work**

71 color images were selected strategically from two hundred images depicting urban scenes dominated by water features from the internet. Using the internet made it possible to collect a large picture set from around the globe and with greater variation in water features that would not have been possible through on-site visits. The selected images consist of a variety of urban water features such as waterfalls, fountains, jets, still water pools, canals, cascades, pools with fountains etc. Unlike, in the study by Nasar and Lin(2003), where the pictures showed only the water features and the surroundings were cropped, the photos selected in my study contained the immediate surroundings as well. The pictures are also selected as such to depict the relationship the water shares with its surrounding. This is because, in reality, we do not perceive any one

element of an environment as a separate entity but relate it to the rest of the surroundings to judge the overall ambience.

The variety also incorporates parameters such as color of water, depth of water, relationship with vegetation, relationship with built structures, moving and still states, the shape and treatment of the water containers or the edges, quantity and proportion covered by water in the scenes, the presence and absence of aquatic vegetation and pets(fishes).

The selection of photographs was made to include the suggested predictor variables as discussed earlier like:

- ✓ Perceived water quantity
- ✓ The degree of naturalness
- ✓ Contrast
- ✓ Reflectivity

Water with low quality was not selected, for instance, polluted water with surface foam or scum, excessive algae, haphazard growth of aquatic vegetation (weeds), ruined or defaced sculpture or container. While selecting, care has also been taken such that the both the overall and immediate surroundings doesn't impel the feeling of disgust, insecurity and doom.

Apart from the easy availability of large quantity and variety of settings, the photo rating method was also chosen over on-site survey since in photos it is possible to control for the negative environmental factors and therefore participants can focus on the given task without having to face any other obstructions or distractions like loud noise, bad smell, uncomfortable wind, thermal discomfort, bad weather, excessive crowding and other negative extremities of an environment. Several studies have assessed the validity of using slides and other simulations (Ulrich, 1993). Also, according to Kaplan and Kaplan (1989, pg. 16), people's responses to two-dimensional representation are surprisingly similar to what they are in the settings itself. It is very much understood that the negative aspects of environments are not always controllable in real sites. It should be remembered, our goal here is to guide future projects towards attaining a restorative environment using water features.

The categorization of the stimuli was general and not divided into separate groups so as to make it as simple as possible for the participants. It will help the participants to rate the environment with

minimum effort avoiding confusion and uncertainty. Such simple method was also expected to save large amount of time, which was one of the major concern in the particular study.

#### 4.2.1.2 Participants

50 people ranging from the age of 15 to 58(mean = 28.04; SD= 10.65) participated. Male (n=24) and female (n=26) were present in almost equal numbers. Most of the attendees were young students (n=29). The occupational or educational background of the people varied to a larger extent. The participants were mostly the original inhabitants of Kathmandu Valley.

#### 4.2.1.3 Procedure and measures

The program took place in the banquet hall of a party venue in Jawalakhel in Lalitpur City of Nepal at 1100 hours on 22<sup>nd</sup> January 2011. The banquet hall was spacious and warm with comfortable seating arrangements. The selected 71 images of urban environment with water features were shown (with the help of a projector) on a white piece of cloth (5'X 4') as a background on the wall. The viewing distance ranged from 9 feet to 15 feet. The participants were asked to rate each image on the scale of 1 to 5 (where 1 means lowest preference and 5 means highest preference) based on their own personal preference or upon how good they might likely feel within such an environment or place. The viewing time for each slide was not more than 15 seconds. In the end, information like age, gender, nationality, occupation and educational level of the participants was also collected.

**Preference study**  
**The Role of Water Features as a Restorative Component in Small Urban Spaces**

You are kindly requested to rate the shown pictures of an environment consisting of water features on the basis of your preference (how good you might likely feel within such an environment). Please tick or circle on the scale of 1 to 5 provided, where 1 means lowest preference, and 5 meaning highest preference.

Image No.1	scale	1	2	3	4	5
Image No.2	scale	1	2	3	4	5
Image No.3	scale	1	2	3	4	5
Image No.4	scale	1	2	3	4	5
Image No.5	scale	1	2	3	4	5
Image No.6	scale	1	2	3	4	5
Image No.7	scale	1	2	3	4	5
Image No.8	scale	1	2	3	4	5
Image No.9	scale	1	2	3	4	5
Image No.10	scale	1	2	3	4	5
Image No.11	scale	1	2	3	4	5
Image No.12	scale	1	2	3	4	5
Image No.13	scale	1	2	3	4	5
Image No.14	scale	1	2	3	4	5
Image No.15	scale	1	2	3	4	5
Image No.16	scale	1	2	3	4	5
Image No.17	scale	1	2	3	4	5
Image No.18	scale	1	2	3	4	5
Image No.19	scale	1	2	3	4	5

**Figure.** Example of paper handed for rating preferences.

### 4.2.2 Analysis

The mean for each photo was computed based on the ratings provided by the participants. The pictures were sorted on the basis of highest mean values (most preferred) and lowest mean values (least preferred). I then carefully analyzed and extracted common traits of the fifteen most preferred and the fifteen least preferred images separately. The following predictor variables discussed earlier were also tallied and analyzed with all the thirty images selected:

- ✓ Perceived water quantity
  - Surface area covered by water
  - Color of water
  - Visibility of depth
  - reflectivity
  
- ✓ The degree of naturalness:
  - presence and absence of vegetation and greenery at the edges or on the immediate surrounding
  - Presence and absence of aquatic life (flora or fauna)
  - The shape of the water edges
  - Motion of water
  - Sound of water
  
- ✓ Reflectivity
- ✓ Contrast

### 4.2.3 Result

The highest mean was 4.369 and the lowest was 2.340. In the selected fifteen most preferred images, the mean average ratings ranged from 3.673 to 4.369. While, in the fifteen least preferred settings, the mean average ranged from 3.043 to 2.340.

Below, as an outcome of the study, are the examples with basic graphic representation of the five most preferred and five least preferred settings:

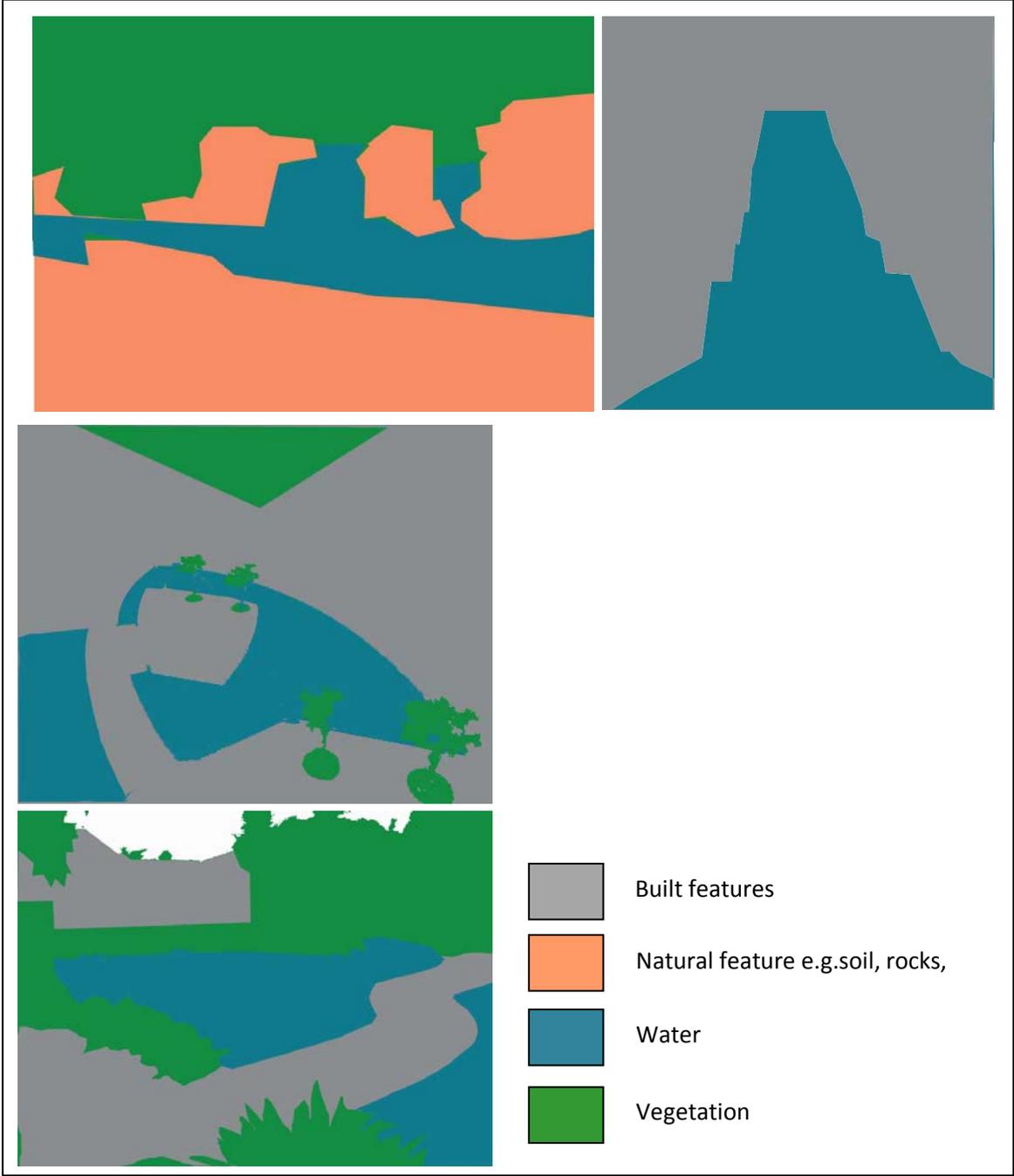


Figure. Set of graphical representation of most preferred settings or scenes.

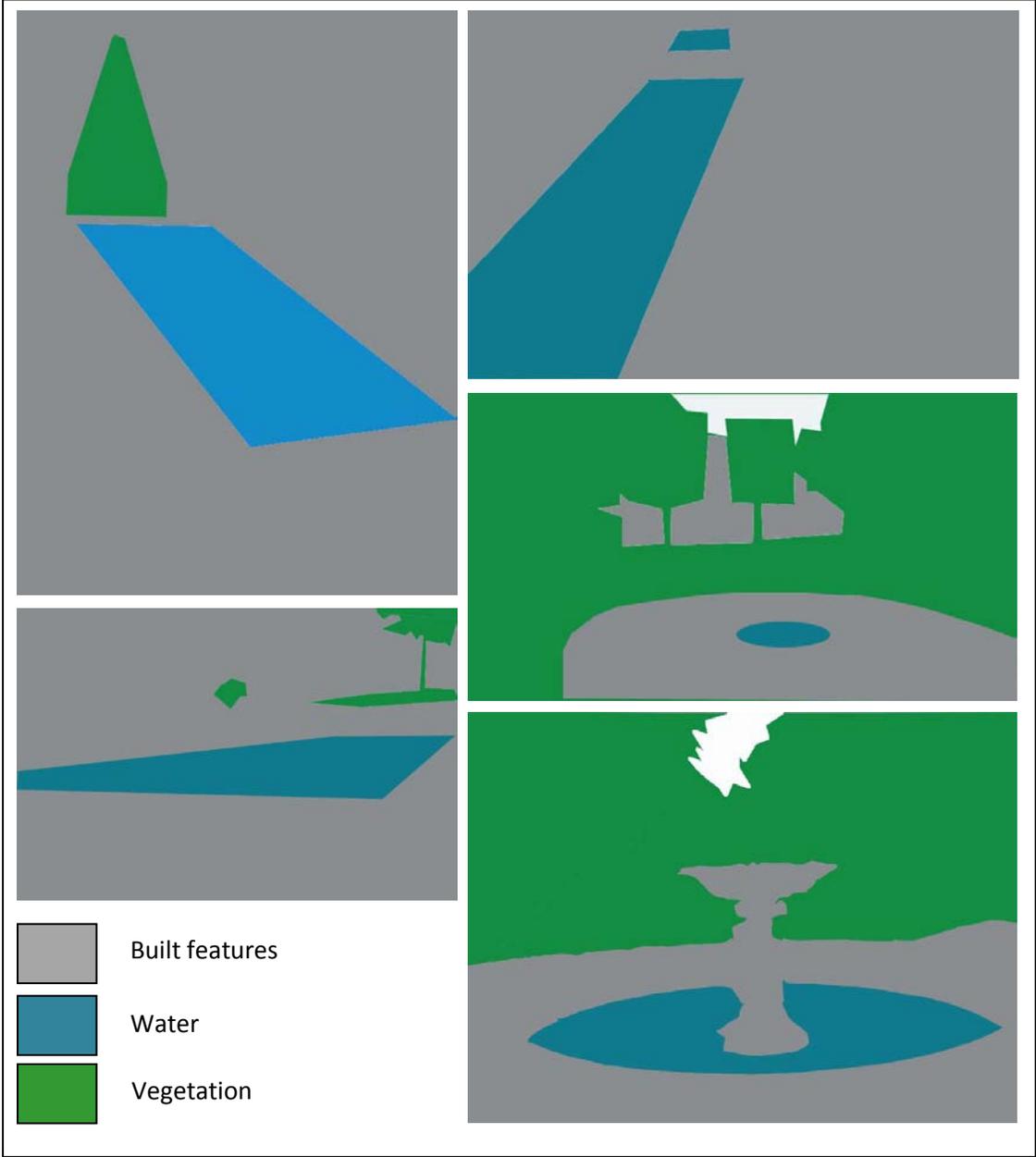


Figure. Set of graphical representation of least preferred settings or scenes.

#### **4.2.3.1 The common traits of the most preferred settings**

The most common feature amongst the most preferred scenes was that the water quantity was perceived higher especially in relation to the built characteristics. In preferred images the visible water was dominating the scene or at least was in balance with other features, especially with built structures. Water is perceived to dominate or balance a scene if proportion of water coverage or surface is larger; greater depth of water or perceived deepness is greater (especially when depth is not visible); hues or shade of the color of water is darker; water is gushing or rushing(white water) ; or water surface is reflective in nature.

Another common trait amongst the preferred scenes was high degree of naturalness characterized by presence of vegetation on the edges and immediate surroundings like trees, bushes, grass; presence of large natural rocks, boulders and stones in or at the edges of water; presence of fishes; natural organic edges of water features which are mostly rustic, irregular or meandering (very much evident on the graphical images present here); mild to mediocre movement of water; mild to mediocre sound of water.

In many of the most preferred scenes, water created a contrasting appearance with respect to its edges or its surroundings. The contrast is mostly evident due to the high difference in color, texture or movement between water and the surroundings (specially built structures). The water on the most preferred scenes had mild or mediocre reflective surfaces.

The most preferred scenes also featured water with darker hues and shades of green and blue.

#### **4.2.3.2 The common traits of least preferred scenes**

The least preferred scenes were associated with perception of water quantity being less. It was characterized by low percentage of surface coverage mostly in relation to built features; shallow or visible depth of water; light hues or shades of the color of water; still water; and no reflectivity.

The degree of naturalness elicited by water was low in the least preferred scenes— less presence of shoreline vegetation and to its immediate surroundings; strict, simple or artificial geometrical

forms of the edges (rectangular, square or circular); raised edges or plinths made up of concrete or tiles; highly restrictive designs discouraging accessibility.

The appearance of water was least contrasting with the edges or the surroundings. And the color of water which seemed to be least preferred is brownish and yellowish green.

### **4.3 General discussions**

The thesis aimed at finding the value of water or water features in urban landscape. The objective was also to understand the qualitative parameters of water features which aid restoration. The results from the observation study showed that water attracts people and that people are fond of spending time near water features with diverse range of purposes like resting, reading, conversing, eating, meditating or simply contemplating. Greater density of people near water features than other areas in the site verifies the fondness towards water. Behaviors of the users on the site also indicated the calming effect of the environment. It was also specifically noted that children are more attracted to water than adults. It was interesting to see the similarities in such interactions and activities between the two contrasting cultures (i.e. in Nepal and Sweden). However, in Swedish sites, both teenage girls and boys seemed least attracted to the environment with water. While, the study in Nepal showed only young teenage boys are least interested in such an environment; young teenage girls in Nepal seemed highly attracted to the environment with water. The linkage of water and children found in the study can also be related to the findings from Coss and Moore (1990) and Zube et al. (1983) where they observed children's preference for water from very young ages.

The other major indication of the study was the attraction of people towards the water features with fishes. Fishes in the water stimulated interest, holding people in the place a comparatively longer time. It can be highlighted from the study that fishes can make the water or water features look more interesting. The presence of fishes in the water, have been found to be positively associated with preference and stress reduction by Katcher et al. (1984); and DeSchraver and Riddick(1990). The frequent stops by the passers-by to simply gaze or to take a picture of the water bodies, especially those accompanied by fountains or jets, or those consisting of aquatic pet like fishes, is suggestive of its charm.

One of the main important qualities which both the quantitative and qualitative studies indicated is the importance of naturalness reflected by the water features. The high degree of naturalness was found to be more preferred than artificial characteristics. Naturalness of the water features were characterized by presence of vegetation or greenery at the edges and in the immediate surroundings; presence of fishes in the water; organic shapes of water features(edges); gentle movement of water; and gentle sound of water. Many other scholars also have argued that the most preferred scenes are those with high degree of naturalness (Herzog, 1982; Ulrich, 1983; Zube et al., 1983; Kaplan and Kaplan, 1989; Smith et al., 1995; SIMONIČ, 2003; Hagerhall et al., 2004; Ivarsson and Hagerhall, 2008; SEÇKİN, 2010; Völker and Kistemann, 2011).

The result of the studies also showed that perceived water quantity is an important factor in a scene or a setting for it to be liked or preferred. Especially, water quantity that is perceived to balance or exceed the amount or density of built content makes the scene likely to be more preferred. The main factor noted to affect perception of water quantity is the surface area the water covers i.e. a large bodies of water/ higher proportion of water is more preferred (Herzog, 1985; Brown and Daniel, 1991; McAndrew, 1992; Yamashita, 2002; Steinwender et al., 2008; Le Lay et al.2008; SEÇKİN, 2010; White et. al, 2010).Another important aspect that increases the perceived water quantity is the shades of the water's color or its hues – the darker the shade or the hue, the denser the water looks. It was also evident that when the visibility of water's bottom is low, its depth is perceived to be higher. Reflectivity of water also could affect perception of water's amount—when the surface is reflective, it was noted that the water looks comparatively larger. People feel the presence of water more strongly if there is movement and sound. Many preferred scenes in the study contained water with mild movements generating rhythmic ripples and soft textures on the surface.

Contrast created by water is mentioned as an important trait by Whyte (1980) and Volker (2011).In the studies, I found that the outdoor settings with water were more liked especially when the water created a contrast with the built features and at least with its edges or the container. Plasticity and animistic qualities (movement, texture and sound) of water balances or compensates the stiffness, hardness and inertness of the built environment. The hues and colors of water were also found to be important in creating contrast with the edges or the surroundings.

Reflectivity of water is another quality which is preferred by people (Nasar and Li, 2002; Yamashita, 2002). In my studies, it was seen that moderate reflections of vegetations and sky is

associated with positive responses. On the flip side, water reflecting buildings or other urban infrastructures were least preferred.

#### **4.4 Limitations**

The on-site observation study has been successful in gathering important information. However, it could have been more diverse by including more quantity and variations of such places. Also, the total period of observation was approximately 1 month. Better or more information could have been acquired with longer span of time. The study in Sweden was carried out in October/November during which it had already started to become cold and chilly. It definitely could have affected the number of out-goers and their types; for instance, children and families were comparatively seen in lesser numbers.

Another important thing to be noted is that, in Nepal a few of the places under study had demands of monetary compensation from the public for entering the place. This could mean that many groups of people could have been filtered out; possibly, only those people were present in the park that had extreme fascination for water and greenery, and those who could afford the amount of money. Therefore, the future research should take into account these problems and consider all the type of changes that a place goes through—weather, climatic changes, cultural values and other possible forces.

The preference study is carried out in the simplest form and with prompt format. The benefits of such simpler form of survey could be the easy understandability of the whole process by the participants which will help them decide and judge with confidence and ease. The accuracy of such result could be higher and trusted upon because of its less confusing credibility and procedures. However, with such simpler form of research, it could be difficult to promote the findings due to the lack of strict scientific format.

Though photo rating is a popular method used in environmental psychology, the possibility of loop holes being present cannot be denied. The visual quality of water is considered an important factor, but water is also equally positively associated with its feel and the sound of it which was absolutely absent in the research. Also, as the photographic demonstration contained only one perspective (from one vantage point) of an overall environment, the ratings could have differed in an on-site survey.

The observational study in both the countries showed almost similar results. On the basis of this, it might be assumed that the effect of water environments is the same to a larger extent for all; however, more or stronger verification is further needed to support this assumption. Also, it should be noted that the conclusions were partially drawn from the preference study which was carried out in Kathmandu. Hence, it cannot be completely denied that Swedish population might have other preferences. Therefore, in the future studies, similar preference studies could be carried out in different parts of the world which can provide a stronger verification.

## 5.

### Conclusion

Modernization and urbanization has its share of dire consequences, mainly stress related problems which has been on rise all over the world. Hence, it has become of utmost importance to take important steps to abate such urban ills. Architects, designers and planners can play vital roles in shaping a healthier and happier future with the power of design and strategic planning of the cities. Intense densification has made cities devoid of open spaces. Therefore, small spaces with restorative potentials should be created within the cities to mitigate the stress related problems of the urbanites. Hence, the knowledge of restorative components becomes important.

The thesis has helped to identify people's fondness for water and the qualities that make it a favorite. In other words, the restorative potentials and qualities of water in the urban areas have been explored and identified in the thesis. The results indicate that water or water features in urban areas may foster restorative qualities of an environment. Hence, the knowledge reflected by the thesis can be referred as guidelines by architects, designers, planners and even policy makers to create or transform a place into a power place that supports psychological restoration which in both short and long term will benefit public health and the overall wellbeing of the city dwellers.

Basic suggestions for architects, designers and planners while working with water features in urban areas:

- ✓ Water or water features should have high degree of naturalness which may be fostered by:
  - The presence of green vegetation like bushes or trees at the edges or on the immediate surroundings.
  - Organic shapes of water's edges which should also be rustic.
  - Presence of natural materials like stones, boulders or rocks especially at the edges.
  - Presence of fishes in the water.
  - Movement of water.
  - Surface of water leveled to the ground and not rose.

- ✓ The water should be present in higher proportion or at least should be such that it is perceived to be present in higher quantity. The main idea is to visually or psychologically make an impression of water balancing or outweighing the built contents. This can be done in following ways:
  - Increasing the area covered by water.
  - Designing vantage points in such way that water becomes a foreground.
  - Increasing the sound of water and the complexity of the water surface's texture by .continuous motion of the water.
  - Providing water with reflective properties when it is still.
  - Conditioning water and water features such that it features darker hues and shades which also supersedes its depth or bottom.
- ✓ Water should make a contrast with the surroundings or at least with the edges. The contrast can be created with the help of hues and shades of water's colors; movement and sound of the water; color of the container; and shape of the edges or the container.
- ✓ Water should reflect natural elements like green vegetation, mountains, hills, natural rocks, sky etc.
- ✓ Water should be conditioned to feature darker hues of green or blue or bluish green.
- ✓ Water should reflect purity and cleanliness.
- ✓ Formal or informal seating opportunities should be accommodated at the edges or around the water features.
- ✓ Water should be accessible such that it can be touched or physically felt.

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