Water as an Element of Architectural Space Design Study the Psychological Impact of Water on the Occupants of the Space

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Abstract

In recent years, interest has increased in water and its preservation alongside environmental effects. Previously, the focus was on the geographical and health importance of water, but recent studies have discussed the use of water in architectural design and its effects on architectural spaces as well as its environmental effects on architecture. Some studies have examined the psychological impact of water properties on specific areas. The current research investigates the psychological impact of water on the visitors and determines the aspects of water and their effects on the users of architectural spaces to specify positive impact of water in order to utilize them in architectural design. Theoretical results of the current study were then applied in the form of a questionnaire to define the importance of an artificial waterfall in a park and its psychological effects on visitors.

Keywords

Psychological • Water • Design element

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1 Introduction

In different ways, "Water" can be noticed in various fields, including art, literature, planning, design, anthropology, geology, ecology, psychology, mythology, history, and religion. Sociologists emphasized the significance of water to humans' impression, estimate, and interpretation of spaces. The contemporary landscape planners and designers constantly acknowledge the importance of water in their works (Burmil et al., 1999).

There have been numerous studies that took into account water and its involvements with many fields of science, whether literary, geographical, health, or even psychological sciences, For example, Seçkin conducted studies that investigated the means in which man uses water in landscape design, basing Maslow prototype. Volume, shape, and sound of water as design factors that affect the way humans use water in exterior space design were also studied(SEÇKİN, 2010). Burmil argues that water has a great psychological impact on humans that must be closely observed besides the basic human needs for water in dry places (Burmil et al., 1999). Hawley, on the other hand, studies the aesthetic and psychological factors affecting humans when designing exterior spaces, with water being the most influential (Howley, 2011). Nasar and Li believe that people prefer reflections of objects on the water surface rather than reflections on other surfaces, i.e., mirrors (Nasar & Li, 2003). Lifang et al. researched the psychology of designing landscapes around river banks, using a hierarchic analysis method to lay a foundation for designing natural riverside scenes in urban areas (Lifang et al., 2008). By and large, Vernon and Tiwari investigate the effect of water on evoking feelings of belonging or nostalgia to places, as they point out that water gives a certain identity to places and increases feelings of belonging (Vernon & Tiwari, 2009). Yamashita, on her part, attempts to evaluate the perception of water in exterior spaces, using cameras. She claims that different age groups have a different perception of such designs, as adults can sense the medium dimension of water while children can only

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perceive shorter dimensions (Yamashita, 2002). Finally, in his study, Völker investigates the hygienic effect of water on the psychology of humans, as he presents water with the blue color, since blue is associated with comfort and serenity, which ultimately gives positive psychological impressions to humans, not to mention the direct hygienic effects of water on humans' well-being (Völker & Kistemann, 2011).

Accordingly, this study is an attempt to present water as an architectural element and its impact on the human psychology. Therefore, a necessary theoretical basis will be presented that can be used in the (Method).

1.1 Water In The Earlier Civilizations

The existence of water was a considerable factor to the emergence of many civilizations and their persistence for long periods. For example, the Roman and Greek civilizations, Egypt and Mesopotamia were founded along river deltas (Hall, 2001; Mumford, 1989). Ponds of water were found painted on the walls of Egyptian temples thousands of years ago, presenting the theme of Water. Here, water is used as an element in the gardening and landscape design. The use of water in Pompeii's villas, the old Roman city, was an important element, later it was used in gardens design. (Burmil et al., 1999). Also Water is an effective element in the Chinese gardens. When the Chinese were planning a garden, the first step was to check the source and flow of water available at the site. This is due to their belief that water serves the balance of other elements in nature. So pools, ponds, waterfalls, wells, and fountains were introduced into landscape that create fantasy and ambiguity (Burmil et al., 1999). Water in Islamic vision has a distinct location. Water is mentioned in many places in The Glorious Qur'an in addition to the ponds and rivers that flow in Paradise. Islam has organized water distribution systems, which is less similar in other civilizations. Islam orders people to use water in an economical form without extravagance and waste even when it is used in some worshipping rituals. Therefore, the garden design in Islamic civilization employed water as a central element, which integrated religious symbolism (Plumptre, 1993).

1.2 Water As a Design Element

1.2.1 Water in Landscape Design

From earlier civilizations till the present day, water has and does constitute a significant element of landscape design. Asakawa et al. believe that "to achieve highly preferred scenery in these stream corridors, there are three necessary components of natural scenery: water, vegetation, and sequential experience with variety"(Asakawa et al., 2004, p. 177). As a result of the formidable favorable response to water, its positive or substantial valuable general quality, and as a reason for its importance for ecosystems we perceive water as a major topic in design problems (Steinwender et al., 2008, pp..124–125). Karmanov and Hamel pinpoint the need of water for healthy urban environments. They integrated aspects regarding aesthetics, civilization, and environment in their definition (Karmanov & Hamel, 2008, p. 123). Through the history of garden design, water has been discussed. Repton finds a great significance of water in landscape design as a result of the contentment created by the glimmer of water and by the wonderful and joyful impact that can be felt by a small pond. Indeed, he used to include a pool in his designs even if it was not naturally appropriate (Burmil et al., 1999, p. 103). Water in design has oftentimes been linked to the emulation of water in nature. Natural water is also important as it can be considered as a muse when designing urban open spaces and fountains (Burmil et al., 1999).

It is important to note that designers have utilized a multitude of optical and non-optical attributes of water in landscape design water could be found in a stagnant state of motion at various places and it could also be shallow or deep or reflective of the surrounding elements and surroundings. It could also appear in several colors and produce many sounds, and when it's touched it can give a comforting sensation as well. Its color variations are associated with different attributes. Bluewater, for example, is linked to a kind of impressions of coldness, white water suggests strength, and thunderous sound (Litton, 1974).

1.2.2 Water in Interior Spaces

Water has been heavily used as a design element in interior spaces, for example, in fountains and small pools, alongside a multitude of uses. Arabs in Andalusia used to adorned their palaces, houses, gardens, and mosques with fountains of various shapes and sizes according to the spaces in which these fountains are placed, with the basic concept of squirting water upwards or in different directions. Water was mainly used in these fountains for drinking and ablution. For instance, water was also used aesthetically to reflect interior facades, add interesting motion in empty spaces that may seem dismal if left with no smart and attractive treatment, in addition to being a tool to mask noise coming from the surrounding environment. According to Feng Shui,[1] water fountains can be placed at one side of a room to add an aesthetic element to the room, as well as the bubbling of the water that gives feelings of relaxation and tranquility.

[1] Feng Shui is the Chinese art of design and placement. Chinese people thought that humans inhabit an energy filed. Feng Shui is concerned with the study of this fundamental energy. It is the basic comprehension of energy, in regard to its flow, manners and pattern, in a certain space.

1.3 Water and Human Perceptions

"Perception" is achieved through employing human senses to create emotions and stances toward anything. Water plays a vital part in the understanding of nature (Herzog et al., 2000, p. 341). Important aspects of the sensual perception of water are its sound, color, clarity, motion, and context (Völker & Kistemann, 2011). Designers tend to use water in design when they want to provide space that suggests joy, calmness, and comfort only (SEÇKİN 2010). Bachelard (1983) theorizes that water gains its aesthetic value as a result of its being a natural element which goes in harmony with the psychological theory that humans prefer natural elements (Nasar, 1990; Nasar & Li, 2003).

Waterscapes are designed for the enjoyment of humans alongside other reasons. As such, the designer has to provide important factors like explicitness and unity, in addition to creating a sense of participation through intricacy and ambiguity (Coeterier, J.F. 1996; Völker & Kistemann, 2011). Water has significant biophysical attributes which make the observer recognize blue spaces as an area that generates a feeling of pertinence and attachment towards water. Water is recognized as being nature's mirror, inspiring mystique by creating images that are not as clear as the images reflected by man-made mirrors (Burmil et al., 1999; Nasar & Li, 2003). Fascination, compatibility, attention, and calmness generated when looking at waterscapes are a translation of mental immersion (Laumann et al., 2001; White et al., 2010). Particularly, water could have a positive impact on the mental state in comparison to other environmental elements (Felsten, 2009). Also, water is not only used by individuals, as it could also be employed as a link between people to bring them together in leisure activities (Program & Fredrickson, 1999). Regan and Horn discovered that when people are in a stressed state of mind, they would feel relaxed when seeing waterscapes (Völker & Kistemann, 2011).

1.4 Water and Negative Ions

The atmosphere is filled with "negative ions" that present a plethora of several psychological and physical benefits. It is determined that the existence of water sprays in some places such as waterfalls results in waves of negative ions, which leads to high levels of serotonin. Serotonin plays an important role in human's temper, intellection, sleeping, and eating patterns. Serotonin levels in blood could treat some mild cases to moderate depression. Up to 10.000 negative ions can be found in the proximity of waterfalls, but their value does not come close to 100 at rush hour in major metropolises.[2]

[2] http://www.health-benefit-of-water.com.

1.5 Water and the Sense of Place

"Water sensitive urban design" was primarily a constituent of a policy strategy regarding water demand management. Nevertheless, "water physical urban design" has evolved, based on the realization that the "natural environment" is an important part of the sense of place (Hedgcock & Mouritz, 1993). "Water sensitive urban design" can also participate in creating a sense of place and establishing a local identity (Vernon & Tiwari, 2009).

"Sense of Place" is considered thematic for any practice of placemaking. It is substantial for the prosperity of a community through generating emotions of security, safety, a feeling of glory and belonging (Schultz, 1980). Placemaking does not only deal with the materialistic aspects of a place that serve the function but also with the manner those factors can create an environment by improving the "sense of place (psychological value)". Therefore, the integration of meeting the materialistic practical psychological requirements of users is considered crucial in making an appealing space. Furthermore, water sensitive urban design methods participate in the materialistic structure of space, and most significantly they participate in creating a suitable environment (Vernon & Tiwari, 2009). In addition, a sense of place in waterscapes is associated with feelings and "a symbolism difficult to achieve with any other natural element" (Whalley, 1988, p. 145).

1.6 Characteristics of Water

1.6.1 Sound of Water

Nature announces the presence of water in a joyous way that is by sound. The characteristics of music are found in water's sound, like diversity in volume, softness, rhythm, intensity, and harmony, which is the most important characteristic. Mass of individual water units falling from cascades that land on the surface create sound. The level of sound from water can vary from absolute silence to a roaring volume (architecture and water, 1994, p. 13). Sound can be considered a substantial element in the human experience of water in the landscape as a standalone element or combined with other visual elements. Sound is created as a result of the movement of water down cascades, through or above obstacles, and by lifeforms like fish and animals, making a movement through its surface. Water possesses a perpetual range of sounds. They range from the delicate sounds of single drops hitting the surface, the accelerated sounds of currents, or the thundering roar of a waterfall. Sound could indicate the presence of water even when it is nowhere in sight. (Burmil et al., 1999, pp. 100–104). On another hand, the sound of water performs several functions, water with vigorous energy and rapid flow falling from cascades or

waterfalls invigorate the user. On the contrary, calm water with tranquil energy could perform the task of soothing and calming the user. Water, whether it comes in the forms of a trickle or a flow, can be tampered to achieve a certain set of design aims. Additionally, users can be informed of the existence of water through sound. Thus, they are provided with a sense of being in a safe environment. And from the design standpoint, this presents water as a heard element rather than seen. Another function that water could serve is disguising raucous detestable surrounding noise, though there is the possibility of the water becoming very loud in that process (SEÇKİN, 2010, p .7).

1.6.2 Reflection of Water

Water is a distinctive natural material. It can reflect light waves through its surface. Along with seeing the surface of water, images of the surrounding environment could also be reflected at its surface. n the condition of water having a calm surface, it can display quite vivid images of mountains, crags, plants, wildlife, and in some cases, the image of the observer himself is reflected. If the calm surface of the water is disturbed by a gust of wind or the movement of the water itself, the reflected images lose their acuity and high level of detail, producing images that resemble the works of an impressionist artist of the surrounding environment (Burmil et al., 1999, p. 100). Bachelard (1983) outlines that the images created by water are more natural and pure than the mirrors made by man. Seventy-two years earlier, Wright (1928) hypothesizes on the aesthetic value of reflective water and deemed it as "refreshing and beautifying in architecture, if architecturally used" (Nasar & Li, 2004). Water reflection is considered a significant feature. Hubbard and Hubbard claimed that harmony and enrichment could be achieved through the use of reflective water as it adds attractiveness. Small forms of water could catch the attention of the observer. These thoughts and notions are thought to have implications in design, because the reflectivity of water could be altered through varying the color of the containing surface. (Nasar & Li, 2003). Also, recent landscape theorists identified with the aesthetic value provided by reflective water (Burton & Litton, 1974). From a psychological viewpoint, Kaplan notes that "water itself provides a continuing, unifying theme to the landscape and one that calls attention to itself. It has a texture that easily sparkles, reflects images, or ripples with the wind" (Kaplan, 1977). It is thought that water itself or reflective water may possess restorative abilities (Nasar & Li, 2003, p. 237).

1.6.3 Movement of Water

A motionless small pool of water or a vast ocean can ingrain a feeling of serenity and peace. Undulations in water could be caused as a result of water flow in rivers or canals aided by gravity or caused by the tidal flow of seas. This mild stimulation of the water surface could cause changes in one's mood. The instilled feeling differs based on the water mass and velocity of the calm and soft or writhing, sensuous undulations. The term "black water" applies when the water surface is undisturbed regardless of how vigorous the movement is, whereas the term "White Water" is used to describe forms of water such as cascades, waterfalls, and tsunami. (Dreiseitl & Grau, 2005). The movement of water takes various forms, which could highly contradict with the tranquil elements on its borders (Burmil et al., 1999, P.100). Slow changes in the velocity of water often lead to a feeling of monotony, immobility, and boredom. (Burton & Litton, 1974). Few movements in nature around found attractive by humans; of which is the movement of water, with its variety and flow. Motion, by itself, or combined with sound has been viewed to have a substantial impact on people's understanding and evaluation of picturesque river landscapes (Burmil et al., 1999). What is more, Symmes explains that the water movement can be invitingly gentle or frighteningly destructive and there are no two water jets or waterfalls are exactly alike since moving water produces an infinite range of changing forms and sound designs (Symmes et al., 1998).

1.6.4 Colors of Water

Pure water has no odor, color nor taste. Although in nature, water oftentimes appears in various colors that range from a dark gray that seems impermeable to a marvelous blue or appears transparent. This multitude of appearance is a result of alterations in lighting, the daily and seasonal positioning of the sun, alongside cloud cover, atmospheric and aquatic particles (Burmil et al., 1999). Eroded materials that are found within the water could also play a part in its apparent color. The Colorado River was named the Red River due to the color of the mud it transfers. Colors could also indicate what sorts of aquatic species inhabit it (Leopold & Davis, 1966). The color of water has different notions to be associated with: blue could be linked to coolness while white with power and thunderous sound (Litton, 1974). In general, blue water is favored over yellow water due to high concentration of yellow substances. (Smith et al., 1995). Color and clarity are considered the determining factors to the public in perceiving water quality of a river (Pflüger et al., 2010). The majority of color we see in the water is a product of the surrounding environment which is reflected on its surface, or the seen objects underneath due to the transparency of water. There are various degrees in which one sees colors according to one's viewing angle. This variety could be explained by physics as a result of the differential refraction angle between air, water, and light. The passing light is absorbed by the transparent medium. That source of light is oftentimes the blue sky. The color of water gets deeper and darker when the light intensity is reduced (Dreiseitl & Grau, 2005).

1.6.5 The Form of Water

Water does not have a specific form. According to the laws of physics, water takes the shape of its container. Water could be naturally found in various forms, for example, it could fill in valleys and create lakes and take and follow a winding course through arroyos. These various forms can vary in size, shape, and depth. (Burmil et al., 1999). Alterations in the flow of water could result in altering the looks of streams, resulting in changing or the removal of particular forms of water. For instance, vertical forms (waterfalls), angular (cascades), and horizontal forms of water and other forms might cease to exist altogether. (Burmil et al., 1999). Seçkin discusses the formal and casual settings of water features, describing natural forms with organic shapes and edges that are on the softer side as casual while deeming angular shapes with geometric properties as formal. When it comes to designing water features, he believes that the water edge is a crucial factor that plays a part in creating the perspective that acts as a liaison between people and water. He describes it as the link between the space that surrounds the water feature and the water feature itself. He also states that the lack of the design's accuracy or the definition of the edge, would weaken the design and affect the clarity of the message it aims to send. (SEÇKİN, 2010).

2 Method

The psychological effect of water design characteristics in parks will be examined. The case study will be chosen by selecting a park that contains water in its design. After determining the possible psychological effects of the water characteristics, a questionnaire will be conducted for the visitors of the selected park. The questionnaire will include the design characteristics of water and possible psychological effects that have been studied in the theoretical study.

`Şelale Park' was chosen for this study to determine the psychological effects of water on humans and the most impactful characteristics of water. Şelale Park was built in 2009 (see Fig. 1) and it is located in the city of Eskişehir, Turkey. Şelale Park attracts thousands of visitors. The park consists of an artificial waterfall that ends in an artificial lake. The park also includes a cafeteria, children's playground, and gym. Moreover, the park sports a captivating panoramic scene over the city of Eskişehir.

A questionnaire was designed requiring visitors to `Şelale Park' in the city of Eskişehir in Turkey to determine the significance of the artificial waterfall for them and to determine the psychological effects of the existence of water in the form of waterfalls, rivers, seas, fountains, or lakes on humans in general and people being questioned in particular. Some aspects of water were excluded from the current study, including the strong movement of water [raging of water] as artificial waterfalls are calm by nature (as humans have different feelings towards calm and raging seas), and the aspect of time, i.e., summer and winter times (as water in the summer has an environmental function in refreshing the air). Values were given to questions listed in the questionnaire for further analysis, results, and conclusions (Table1).

3 Results

After utilizing the questionnaire and analysis of the values given for each question, the following results have been concluded:

- 60% of visitors primarily go to the park to see and enjoy the artificial waterfall, while 30% consider the waterfall their second reason to go to the park. Also, it is has found that the existence of water in the park was the primary element which grants joy to the visitors (see Fig. 2).
- percentages of the various characteristics of water were close, ranging between 20 and 27% for all characteristics except color of water as it has been found to have no significant effect [this may be because the waterfall is colorless as opposed to the blue water of seas and green water of rivers]. It has found that there is not a dominant characteristic among others, as different people have different preferences. Figure 3 illustrates the percentages for each Characteristic.
- It has been found that 50% of the questioned individuals feel calm and relaxed upon seeing the waterfall, 26% feel happy, 26% feel optimistic and hopeful, and 20% feel invigorated and enthusiastic. This means that water has various positive impacts on people (Fig. 4).

4 Conclusions

From the results above, it has been concluded that the waterfall at Şelale Park has added aesthetic value and identity for the park, as most people consider the waterfall to be a fundamental element of the park and the reason people go to the park. Moreover, sound, movement, and shape of water are found to be the distinctive elements of the waterfall that make visitors feel enjoyment and happiness.

It has also been concluded that people differ in their preferences of the various aspects of water; no aspect is dominant over others. Therefore, each aspect must be studied separately to create more appropriate spaces when designing aquatic planes, fountains, and waterfalls. Besides, water had various psychological effects on visitors, which

Fig. 1 "Şelale Park" (Authors)

Table 1 Show the possible values

Park contents [Design elements of Şelale Park] 1	Waterfall	1–1
	Cafeteria	2–1
	Green areas	3–1
	Games	4–1
	City panorama	5–1
	Other	6–1
Design Characteristics of water [waterfalls] 2	Sound of water	1–2
	Movement of water	2–2
	Reflections on water	3–2
	Shape of water	4–2
	Color of water	5–2
Type of Psychological effects of waterfalls design Characteristics 3	Joy, happiness, delight	1–3
	Love, excitement	2–3
	Hope, optimism	3–3
	Relaxation, calmness, comfort	4–3
	Activeness, vitality, enthusiasm	5–3
	Loneliness, pain, sadness	6–3
	Anger	7–3
	Anxiety, tension, stress	8–3
	Fatigue, boredom	9–3
	Fear	10–3
	No effect	11–3

ranged between feeling calm, happy, optimistic, invigorated, and active. It is safe to say that different aspects of water have different effects on people and that people differ in their preference for aspects of water.

Looking at previous studies and the results of the questionnaire, it has been concluded that the element of water is significant in parks and open areas due to their aesthetic, climatic, and psychological effects on humans. These effects must be taken into consideration when designing spaces.

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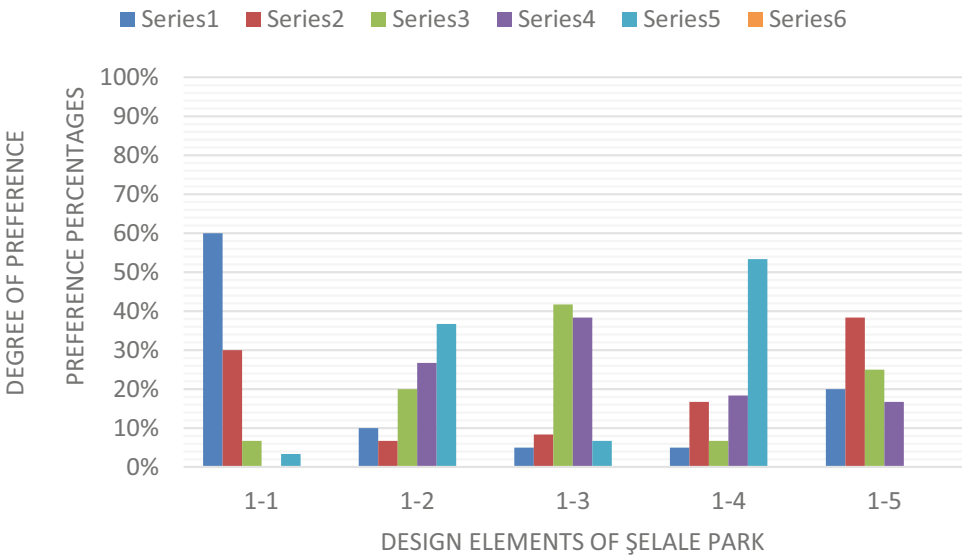

Fig. 2 A graph chart showcasing percentages of the most important elements in the park

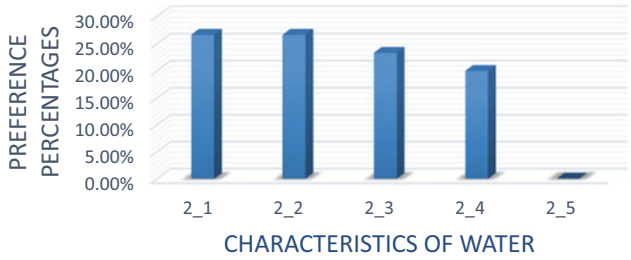

Fig. 3 Design characteristics of the water and the proportion of their preference according to the results of the questionnaire

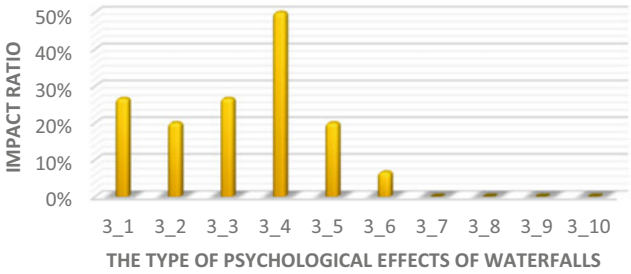

Fig. 4 Show cases The percentage of each type of psychological effects for waterfall design characteristics on the user according to the questionnaire results

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