

Biophilic architecture and water: Examining water as a spatial sensory element

Damla Katuk¹ , Assoc. Prof. Dr. Emine Köseoğlu^{2*} 

¹Fatih Sultan Mehmet Vakif University
Institute of Graduate Studies, Master of
Architecture, İstanbul, Turkey.
damla.katuk@stu.fsm.edu.tr

²Fatih Sultan Mehmet Vakif University
Faculty of Architecture and Design,
Department of Architecture, İstanbul,
Turkey.
ekoseoglu@fsm.edu.tr

*Corresponding Author

**This study is prepared from an ongoing master thesis of the first author supervised by the second author, titled "Biyofilik Yaklaşımla Suyun Mekânda Algısal ve Duygulanımsal Boyutları: Çağdaş Mimarlık Örnekleri" which was accepted in the Master of Architecture Program at Fatih Sultan Mehmet Vakif University Institute of Graduate Studies since 9 July 2021.

Received: 24.04.2022
Accepted: 17.10.2022

Citation:
Katuk, D., Köseoğlu, E. (2022).
Biophilic architecture and water:
Examining water as a spatial sensory
element. *IDA: International Design
and Art Journal*, 4(2), 252-270.

Abstract

Biophilic design can be briefly summarized as a concept affecting human well-being and nature. Thus, the inclusion of water in architectural designs has attracted attention. The purpose of this study is to evaluate the sensory perception of water in architectural space designs that can be revealed as examples of biophilic design. Scope of this study, seven contemporary architectural examples were examined within the context of the importance of perceptual aspects of water. This study is a qualitative research design. Data collection methods from documents are used. Two methods are designed for this study. The first method's aim was to analyze to describe the sensory features of water and the second method's aim was to analyze to determine the sensory and perceptual concepts of water in selected buildings. As a result, the concepts that emerged from the analyses affect the relationship between biophilic design, and architecture. The results provide 21 concepts (Noise, Endless, Calm, Curling, Plane, Disappearing, Multisensory, Kaleidoscopic Effect, Infinitely Reflections, Senses, Contact, Eco, Hearing, Part of Waterfall, Illusion, View, Peaceful, Reflection, Dramatic Panorama, Communication, Reflection) from statements describing the relationship between water, human, nature, biophilic design and architecture for the designers.

Keywords: Biophilic Architecture, Architectural Space, Water, Perception, Senses

Extended Abstract

Introduction: Water plays a significant role in life while connecting humans and nature. Water is an important element and directly affects humans' psychological and physiological structures. Water has been a focal point for people and cities throughout history. Accessibility to water has sometimes been a symbolic or vital requirement. Water has the potential to describe a city and make it readable. It can be perceived differently in mind visually and transform the space with its ambiguous form. It is also an element that can affect human psychological and physiological structures. Water is sometimes a substance in which species live, and sometimes it is an element that exists in space. This space turns into a place according to the living things in it. Seen from the opposite side, the human body is a place for water, where water settles. Thus, it is an important element that cannot be separated from human beings. From this point of view, it can be argued that using water elements in architectural designs can affect people differently.

Humans cannot be thought of independently or in isolation from nature. Therefore, nature should be intertwined with the built environment. Biophilic design gains importance at this point. Being detached from nature is a negative result of increasing built environments; thanks to biophilic architecture, it is aimed to integrate nature into architecture. Declining

water resources can also make this rupture more dangerous. Biophilic design can become an area that improves human health in all respects. Thus, this improvement is obtainable through individual space designs contributed by water. Each individual can be healed in his own living space.

Purpose and scope: Biophilic design can be briefly summarized as a concept that affects human well-being and includes nature directly or indirectly. In relation to this, the inclusion of water in the space in architectural designs has attracted attention. Scope of this study, the water element used in the space was decided to examine in 7 contemporary architectural examples of its physical and psychological effects. Water is an element that can activate all of a person's senses in a space. The sound, appearance, tactility, indirect smell, and taste of water are all physical properties. These features support the state of activating the senses. Water is also in constant physical transformation. It is found in nature in solid, liquid, and gaseous states. In contrast, all these physical properties of water reach people and stimulate their psychological perception. It is possible to argue that water spatializes the place through human beings and affects human psychology directly or indirectly. It can integrate the place with people and establish a strong bond with nature. So, it can also be a strong place identifier. Therefore, the purpose of this study was to examine the sensory-perceptual properties of water in architectural designs that can be shown as an example of biophilic design.

Method: In this study, seven contemporary architectural examples were examined within the context of the importance of water in biophilic design. Selected contemporary architectural examples include water in their designs. In this way, they can be considered within the scope of biophilic design. The examples selected in this study are designs that can be included in organic design, which is one of the two orientations of biophilic design that Kellert has stated. It is emphasized that the water element can be experienced by the user directly in the space. The seven selected examples are as follows: Fort Worth Water Gardens, The Robert and Arlene Kogod Courtyard at the Smithsonian Institution, Apple Piazza Liberty, The Therme Vals, Fallingwater, Pulitzer Arts Foundation at St. Louis, and Church on the Water. This study is a qualitative research design that includes data collection methods from documents. Two methods were designed for this study. Analyzes are made on the sensorial and the perceptual dimensions of water in selected contemporary architectural examples by contemporary architects, who can be considered within the scope of biophilic design and include water in design.

Findings and conclusion: Reading results are examined according to first method and second method. As a result of the analyzes made with two methods of reading, 21 concepts were determined. These 21 concepts are Noise, Endless, Calm for Fort Worth Water Gardens; Curling, Plane, Disappearing for The Robert and Arlene Kogod Courtyard at the Smithsonian Institution; Multisensory, Kaleidoscopic Effect, Infinitely Reflections for Apple Piazza Liberty; Senses, Contact, Eco for The Therme Vals; Hearing, Part of Waterfall, Illusion for Fallingwater; View, Peaceful, Reflection for Pulitzer Arts Foundation at St. Louis; Dramatic Panorama, Communication, Reflection for Church on the Water. Concepts were obtained with a categorization derived from the statements of the architects for their own designs or the statements of the users of the designs and those who experienced the designs. It was found that these concepts are predominantly sensory and perceptual. In this case, it was concluded that the water in space could affect human psychology within the scope of the biophilic design and architecture relationship. From this point of view, the ways of perceiving water in contemporary architectural examples that can be given as examples of biophilic design and its relationship with concepts are revealed.

Keywords: Biophilic Architecture, Architectural Space, Water, Perception, Senses

INTRODUCTION

The interaction between humans and nature is a need, and the decline of this relationship is an important problem today. Many studies prove this situation through nature is good for people (Pálsdóttir et al., 2021; Poulsen et al., 2020; Spence, 2020a; Adevi et al., 2018; Hartig et al., 2006). Kaplan and Kaplan (1989: 1) emphasized the importance of nature in their book titled *The Experience of Nature* as follows:

Nature is a valued and appreciated part of life. Examples abound. People plant flowers and shrubs and nurture house plants; cities invest heavily in trees; citizens band together to preserve natural settings they have never seen; landscapes for centuries have been the subject of painting and poetry. Nature seems to be important to people. (Kaplan & Kaplan, 1989: 1)

Ideas to produce solutions to the gap in the relationship between humans and nature in the field of architecture are gathered in the field of biophilic design (Joye, 2007). Since humans are a part of nature like other living things, architecture needs to keep up with this situation. Sometimes by associating nature with space (Joye,

2006), and sometimes by imitating nature (Omran, 2016), designers in this field develop biophilic designs by advancing with the theme of the nature-related design.

Erich Fromm coined the term “biophilia” as “the passionate love of life and of all that is alive”. He also added that this situation could happen in a person, a plant, an idea, or a social group (Fromm, 1973: 365). Then Wilson summarized “biophilia” as “the object of the reflection”. In addition, he defined it as “the innate tendency to focus on life and lifelike processes” (Wilson, 1986: 1). The term biophilia began to be considered as a hypothesis by Kellert and Wilson. They explained the “biophilia hypothesis” as “a human dependence on nature that extends far beyond the simple issues of material and physical sustenance” (Kellert & Wilson, 1993: 20). Finally, the term biophilia was brought into architecture as “biophilic design” by Kellert with two books titled *Building for life* (2005) and *Biophilic Design* (2008). Kellert (2005) defined biophilic design as the instinctive connection of people with the natural world and he described two basic dimensions of biophilic design. These basic dimensions are organic design and vernacular design. The presence of water in organic design is encountered in the table titled “Elements of Biophilic Design” (Kellert, 2005: 129).

In the study published under the title of *14 Models of Biophilic Design* in 2014, the effects of biophilic design in various fields have been examined. Furthermore, the “Presence of Water” model, which was one of these 14 models that is in the fifth place in the *Nature in the Space Patterns* section, has been emphasized. According to this model, the presence of water enriches a place's experience through seeing, hearing, or touching the water. The purpose of the Water Presence model has been exploited the multi-sensory properties of water in a way that soothes the experience of a place, encourages reflection, improves mood and provides healing from cognitive fatigue (Browning et al., 2014: 32). The effect of the presence of water in a place on stress, cognitive performance, emotion, mood and preferences has been supported by various studies such as reducing anxiety, increasing feelings of tranquility, lowering heart rate and blood pressure, improving concentration and memory restoration, enhancing perception and psychological responsiveness (Spence, 2020b; Abdalrahman, 2020; Dabbagh, 2018; Hongisto, 2017).

Once the relationship between biophilic design and water has been considered, it is seen as a direct experience of nature in terms of experiences and attributes (Kellert & Calabrese, 2015: 10). In this context, in the article titled “Nature Connectedness and Biophilic Design”, pathways to nature connectedness to enact the biophilic design principles have been examined in the framework created to research on the psychological construct of nature connectedness. In this framework, the interaction of water with biophilic design principles (senses, emotion, beauty, meaning and care) has also seen in the direct experience category (Richardson & Butler, 2022: 40). In another article, water have been identified as one of the 19 overlapping concepts with the content analysis method. These concepts have tried to integrate biophilic design with healthy, sustainable, and resilient environments (Cacique & Ou, 2022).

The purpose of this study is to evaluate the contemporary architectural designs associated with water that can be revealed as examples of biophilic design. This evaluation was made on how the sensory perception of water in the architectural space. Within the scope of this study, the water element used in the space is examined within two groups: the physical and psychological effects of water. When these two groups are compared to each other, the psychological effects of water in human health are less clear than the physiological role (White et al., 2010: 482). Therefore, in this study, the physical and psychological effects of water on people in the environment are discussed together.

METHODOLOGY

In this study, the sensory and physical properties of architectural designs, which can be considered examples of biophilic building designs, are addressed. The examples selected in this study are designs that can be included in the organic design, one of the two orientations of biophilic design specified by Kellert (2005: 127). It is emphasized that the water element can be experienced directly in space. The seven examples selected are listed below (Table 1). In this table, there can be seen information about the buildings' names, the author, architects of buildings, locations of buildings, completion years of buildings, and type of water features in these buildings (Table 1).

Table 1. Selected contemporary architectural examples

Building	Author Architect	Location	Date	Water Feature
Fort Worth Water Gardens	Philip Johnson and John Burgee	Texas, USA	1974	Cascade, Wet wall, Quiet pool, Reflecting pool, Aerated pool, Active pool
The Robert and Arlene Kogod Courtyard at the Smithsonian Institution	Foster and Partners	Washington DC, USA	2007	Water scrim, Removing rainwater from the roof structure
Apple Piazza Liberty	Foster and Partners	Milan, Italy	2018	Glass fountain, Vertical jets
The Therme Vals	Peter Zumthor	Graubünden, Switzerland	1996	Vals's natural thermal springs and the source, Valser mineral water
Fallingwater	Frank Lloyd Wright	Pennsylvania, USA	1937	A waterfall on Bear Run
Pulitzer Arts Foundation at St. Louis	Tadao Ando	Washington DC, USA	2001	Water court (Linear and rectangular)
Church on the Water	Tadao Ando	Hokkaido, Japan	1988	Artificial pond (created by taking water from a nearby stream)

This study was a qualitative research design, and qualitative data were collected from the documents. Merriam (2018) has classified the document types under six headings for qualitative data collection (132-141). These types of documents are public records, personal documents, popular culture documents, visual documents, physical materials/artifacts and documents produced by the researcher (Merriam, 2018: 132-141). In this context, two methods were designed for this study (Table 2).

Table 2. Qualitative research design for this study

Qualitative Research Reading Methods: Data Collection from Documents	
First Method	Second Method
<p>Aim: Describing the sensory features of water in selected buildings</p> <p>Sample: The Researcher Herself/Himself</p> <p>Data Sources: Documents Produced by the Researchers</p> <p>Data Collection Tools: YouTube Videos about the selected seven examples (Popular Culture Documents and Visual Documents)</p>	<p>Aim: Determining the sensory and perceptual concepts of water in selected buildings</p> <p>Sample: The Statements by the Architects of the Buildings, Theorists and Prominent Professional</p> <p>Data Sources: Individual Documents of People from Literature, Visual Documents</p> <p>Data Collection Tools: YouTube Videos for Interviews (Popular Culture Documents and Visual Documents) Books, Newspapers, Catalogs, Reviews, Essays, and Thesis for Other Statements</p>
Findings	
Reading Results According to First Method	Reading Results According to Second Method
Discussion	
Conclusion	

The first method aimed to analyze to describe the sensory features of water in selected buildings (Table 2). Data sources for this method were documents produced by the researchers. While making this analysis, the researchers examined the YouTube videos containing the buildings (Table 2). It was analyzed the sensory properties of the water in these videos under the titles of “Sound”, “Image”, “Tactile Texture”, “Smell” and “Taste”. It was evaluated whether there is any effect of water in the space under these titles. The first method of this study progresses with some classification tables over the selected spatial examples. In the section on the results of the first method, these tables deal with perceptual senses such as the sound, image, texture, smell, and taste of water. In some samples, precise information about the senses of smell and taste could not be reached. Therefore, it is expressed with a negative mark in the tables.

In order to collect data for the first method, researchers watched YouTube videos about the selected seven examples. In order to understand the water features in the buildings more clearly, videos were preferred with no music in the background, no effect added on image colors, and containing as little speech as possible. While the researchers produced documents by interpreting their sound and image perceptions based on the videos,

they also produced documents by following the user experiences of the touch, texture, smell, and taste features based on the same videos. This can be called an experience of the water features in the place by seeing, hearing, and following the user experiences through video. Since these are determined according to the individual and user experiences watched from the YouTube videos, they do not describe the global properties or fixed properties of the buildings. These are characteristics determined based on experience.

The second method aimed to analyze the sensory and perceptual concepts of water in selected buildings (Table 2). Data sources for this method were documents produced by the statements made by the architects of buildings, theorists, and prominent professionals (Table 2). Sensory and perceptual concepts were determined with this thematic reading. The selected examples of contemporary architecture are limited according to the comments made by the architects who designed them. When an interpretation of the author architect could not be reached, a restriction was brought again according to the comments made by experienced architects or researchers in this field. In this case, the examples were chosen among those that reflect the nature in the space, interpreted by architects or people working in this field, and those that can be conceptualized with a perceptual approach. First, the statements made by architects, i.e., the authors, during the interviews about the selected examples were examined. In the case that the author could not obtain a verbal statement regarding the selected sample, other architects', theorists', and prominent professionals' opinions in this area were included.

In order to collect data for the second method, firstly, the interviews with these authors published on YouTube were examined. In some interviews, their statements about selected examples from Philip Johnson, John Burgee, and Frank Lloyd Wright were obtained. In addition to Wright's statement, his assistant's comments have also been included. About the selected examples from Norman Foster, Peter Zumthor, and Tadao Ando, their statements or statements about their designs have been reached through newspapers, books, catalogs, reviews, essays, and theses. YouTube video footage has also been discussed to understand the experience in the space in all selected examples. In this context, for example structures selected from Foster's designs and both Foster and Partners' statements on their official website and in The New York Times have been reached. For the selected sample structure of Zumthor, Bilgin's book named "Mimarın Soluğu": Essays on Peter Zumthor Architecture was examined. For the sample designs selected from Ando, Frampton's evaluations in the MOMA catalog, Güzer cited Ando's own statement in a book chapter, and the related evaluations in a master's thesis are discussed.

Finally, some inferences were obtained from the statements from the architects themselves or experienced architects about the water element in the selected contemporary architectural examples. These inferences have been translated into some concepts. These concepts have been reached as a result of the statements of the architects or the people working in this field and the examinations made on the spaces.

FINDINGS

Reading Results According to First Method

Fort Worth Water Gardens

This design is located in a built environment, and there are cascades, wet walls, a quiet pool, a reflecting pool, an aerated pool, active pool. In YouTube videos of this design, the water feature appeals to the three senses. It is considered a versatile element and it sometimes has a very strong sound, and sometimes it creates a surface that flows silently from the walls (Figure 1). In this case, two different opposite directions of water can be seen. The silence that allows the sound to emerge and the silence of the water itself can be experienced. Humans can experience space in the flow of water in different directions. Humans can experience water by hearing, seeing, touching in space.



Figure 1. Fort Worth Water Gardens, Photography: Carol M. Highsmith America Collection in the Library of Congress

When water features mentioned properties are evaluated together, the presence of sound, image, and tactile texture features can be observed on YouTube videos. YouTube videos found no statement regarding the senses of smell and taste (Table 3). Considering the mentioned properties of water according to its physical structure, it is possible to exist in liquid form and vapor forms. Considering the climatic conditions of the place where the design is made, water has no chance of appearing in a solid form. Considering the aforementioned properties according to the flow direction of the water, vertical, horizontal, and multi-directional movements are available.

Table 3. Sensory features of water in Fort Worth water gardens

Sensory Features of Water				
Sound	Image	Tactile Texture	Smell	Taste
+	+	+	-	-

The Robert and Arlene Kogod Courtyard at the Smithsonian Institution

This design is a courtyard in a historical building and is located in a built environment. In YouTube videos of this design, the water feature is directed horizontally and vertically and appeals to the three senses. The water is placed on the ground in bands (water scrim) that do not fill a volume. Humans can experience water by touching this band. The process of removing rainwater from the roof structure, which is the main character of the design, also emphasizes the sound of water. Rainwater on the wave-shaped glass structure passes away through the columns that carry the structure (Figure 2). During this transition, the flow of water is heard through the columns. At the same time, rainwater can be heard in the glass structure on the roof.



Figure 2. The Robert and Arlene Kogod Courtyard at the Smithsonian Institution, Photography: Chuck Choi

When water features properties mentioned above are evaluated together with sound, image and tactile texture features found on YouTube videos. No statement was found regarding the senses of smell and taste on YouTube videos (Table 4). Considering the mentioned properties of water according to its physical structure; it is possible to exist in liquid and vapor forms in the space. There is no statement about the solid state of the water here. Considering the aforementioned properties according to the flow direction of the water; vertical and horizontal movements are available. Although there is no multi-directional movement, the water will move curvedly on the curved roof.

Table 4. Sensory features of water in the Robert and Arlene Kogod Courtyard at the Smithsonian Institution

Sensory Features of Water				
Sound	Image	Tactile Texture	Smell	Taste
+	+	+	-	-

Apple Piazza Liberty

This design is in a built environment with a glass fountain, vertical jets, and two pools. On YouTube videos of this design, the water feature appeals to three senses. The reflective property of glass and the reflective property of water combine. Facade reflections of the historical texture can be seen on glass and water (Figure 3). Humans can experience water by hearing, by seeing, by touching in the space.



Figure 3. Apple Piazza Liberty, Photography: Giovanni Nardi

When water feature above mentioned properties are evaluated together with, the presence of sound, image and tactile texture features was found on YouTube videos. No statement was found regarding the senses of smell and taste on YouTube videos (Table 5). Considering the mentioned properties of water according to its physical structure; it is possible to exist in liquid and vapor states in the space. No statement regarding the solid state of the water here could be reached. Considering the aforementioned properties according to the flow direction of the water; vertical and horizontal are available.

Table 5. Sensory features of water in Apple Piazza Liberty

Sensory Features of Water				
Sound	Image	Tactile Texture	Smell	Taste
+	+	+	-	-

The Therme Vals

This design is located in natural environment, and it is associated with Vals’s natural thermal springs, the source and Valser mineral water. On YouTube videos of this design, the water feature appeals to the five

senses. The water element dominates the spaces between the intersections of the vertical and horizontal surfaces (Figure 4). Humans can experience water by hearing, by seeing, by touching, by, smelling and tasting in the space.



Figure 4. The Therme Vals, Photography: Andrea Ceriani

When water feature above mentioned properties are evaluated together with, the presence of sound, image, tactile texture, smell and taste features was found on YouTube videos. (Table 6). Considering the mentioned properties of water according to its physical structure; it is possible to exist in liquid and vapor states in the space. There is no statement about the solid state of the water here. Considering the aforementioned properties according to the flow direction of the water; vertical and horizontal movements are available.

Table 6. Sensory features of water in The Therme Vals

Sensory Features of Water				
Sound	Image	Tactile Texture	Smell	Taste
+	+	+	+	+

Fallingwater

This design is located in natural environment, and it is associated with a waterfall on Bear Run. On YouTube videos of this design, the water feature appeals to the three senses, and three physical states of water can be seen. It is one of the rare examples where the design is intertwined with water (Figure 5). Humans can experience water by hearing, by seeing, by touching in the space.



Figure 5. Fallingwater, Photography: Carol M. Highsmith America Collection in the Library of Congress

When water feature above mentioned properties are evaluated together with, the presence of sound, image and tactile texture features was found on YouTube videos. No statement was found regarding the senses of smell

and taste on YouTube videos (Table 7). Considering the mentioned properties of water according to its physical structure; it is possible to exist in solid, liquid and vapor states in the space. Considering the aforementioned properties according to the flow direction of the water; vertical, horizontal and multi-directional movements are available.

Table 7. Sensory features of water in Fallingwater

Sensory Features of Water				
Sound	Image	Tactile Texture	Smell	Taste
+	+	+	-	-

Pulitzer Arts Foundation at St. Louis

This design is located in a built environment with a linear and rectangular water court. On videos of this design, the water feature appeals to the one sense. The water feature is located between the masses. On one side, it opens to the void that reflects nature (Figure 6). Water is both an element that reflects nature, and that also reflects the architecture vertically with its closed edges. Humans can experience water by seeing in space.



Figure 6. Pulitzer Arts Foundation at St. Louis, Photography: William Zbaren

When water feature above mentioned properties are evaluated together with, only the definite existence of the image feature was found on YouTube videos. No statement was found regarding the senses of sound, tactile texture, smell and taste on YouTube videos (Table 8). Considering the mentioned properties of water according to its physical structure; it is possible to exist in solid, liquid and vapor states in the space. Considering the aforementioned properties according to the flow direction of the water; horizontal is available.

Table 8. Sensory features of water in Pulitzer Arts Foundation at St. Louis

Sensory Features of Water				
Sound	Image	Tactile Texture	Smell	Taste
-	+	-	-	-

Church on the Water

This design is located in a natural environment and is associated with an artificial pond created by taking water from a nearby stream. In YouTube videos of this design, the water feature appeals to the three senses, and at least two different physical structures of the water element can be seen in this design. While horizontality prevails in the water element design, it is noticed that there are small elevations in it when viewed in detail. The feature of water reflecting nature and architecture is seen in this structure of Ando. It conveys like a silent waterfall (Figure 7). Humans can experience water by hearing, by seeing, by touching in the space.



Figure 7. Church on the Water, Photography: Jason Wolfe

When water feature above mentioned properties are evaluated together with, the presence of sound, image and tactile texture features was found on YouTube videos. No statement was found regarding the senses of smell and taste on YouTube videos (Table 9). Considering the mentioned properties of water according to its physical structure; it is possible to exist in solid, liquid and vapor states in the space. Considering the aforementioned properties according to the flow direction of the water; vertical and horizontal movements are available.

Table 9. Sensory features of water in Church on the Water

Sensory Features of Water				
Sound	Image	Tactile Texture	Smell	Taste
+	+	+	-	-

Reading Results According to Second Method

Fort Worth Water Gardens

In an interview with Johnson on YouTube, he says the following about Fort Worth Water Gardens:

In a middle of town, the only thing besides putting up a honky-tonk ferris wheels are games of chance or Disneyland streets and streetcars was water. Because water does all kinds of funny things. It jumps, it's quiet, it makes mist, it makes fñils, it goes high, goes low, it falls down and make some noise. The background of water works is of course endless in history of architecture and the that's what inspired us. All the successful use of water is to create breaks, to create gathering places and to make separations and to make rivers that run fast and lakes to go calm. So, water has this absolute fascination of impossibility danger falling. It can do things that nothing else can do and effect for our purposes in Fort Worth. Of course, the more water we used and more little things, we had for people to see. (Kera, 2014)

First, when the sensory features of water in the architectural space are examined in the above statement, the determined word is underlined: Noise. The reason why this word is chosen as a sensory feature is due to the sound of water. Besides the sensory features, when the perceptual features of water in the architectural space are examined in the above statement, the determined words are underlined: Endless and Calm. When these two situations are combined, the words chosen from the statements for the conceptualization of water through space are: Noise, Endless, Calm (Table 10). These selected words support both the relationship of water with space and the concepts that can be considered in common with the pure appearance of architecture.

Table 10. Sensory and perceptual features of water in Fort Worth Water Gardens

Statement Type	Thematic Concepts
Interview with Philip Johnson (One of the Architects of the Building) on YouTube	Noise Endless Calm

The Robert and Arlene Kogod Courtyard at the Smithsonian Institution

Foster mentioned in The New York Times:

And the roof's edges curl up subtly to channel rainwater into drains that run down the center of the columns. (Ouroussoff, 2007a)

A series of gorgeous planters designed by the landscape architect Kathryn Gustafson are carved from a soft, white unobtrusive marble. A fountain generates a thin plane of water at one end of the courtyard, its edge disappearing into thin slots set into the granite floor; when the water is turned off, the fountain simply disappears. (Ouroussoff, 2007b)

First, when the sensory features of water in the architectural space are examined in the above statement, the determined word is underlined: Curling. The reason why this word is chosen as a sensory feature is due to the sound of rainwater flowing on the roof and inside the column. Besides the sensory features, when the perceptual features of water in the architectural space are examined in the above statement, the determined words are underlined: Plane and Disappearing. When these two situations are combined, the words chosen from the statements for the conceptualization of water through space are Curling, Plane, Disappearing (Table 11). These selected words support both the relationship of water with space and the concepts that can be considered in common with the pure appearance of architecture.

Table 11. Sensory and perceptual features of water in the Robert and Arlene Kogod Courtyard at the Smithsonian Institution

Statement Type	Thematic Concepts
Architecture Review by Nicolai Ouroussoff (Architecture Critic) in The New York Times	<u>Curling</u> <u>Plane</u> <u>Disappearing</u>

Apple Piazza Liberty

Some explanations about the design on the company websites of Foster and Partners are as follows:

A celebration of the joys of city life and embodying its dynamic nature, the signature water feature is an interactive, multisensory experience. Visitors enter the fountain through a glass-covered entrance enveloped by the sights and sounds of vertical jets of water that splash against the 26-foot-high glass walls. An immersive recreation of the childhood game of running through fountains, the experience changes throughout the day as sunlight filters through the water, while at night the glass ceiling creates a kaleidoscopic effect, with the water falling down the walls, and its reflections travelling infinitely up the sky. (Foster and Partners, n.d.)

First, when the sensory features of water in the architectural space are examined in the above statement, the determined word is underlined: Multisensory. The reason why this word is chosen as a sensory feature is due to the directly related to the senses. Besides the sensory features when the perceptual features of water in the architectural space are examined in the above statement, the determined clauses are underlined: Kaleidoscopic Effect and Infinitely Reflections. When these two situations are combined, the words chosen from the statements for the conceptualization of water through space are Multisensory, Kaleidoscopic Effect, Infinitely Reflections (Table 12). These selected words support both the relationship of water with space and the concepts that can be considered in common with the pure appearance of architecture.

Table 12. Sensory and perceptual features of water in Apple Piazza Liberty

Statement Type	Thematic Concepts
Some explanations on the company websites of Foster and Partners	<u>Multisensory</u> <u>Kaleidoscopic Effect</u> <u>Infinitely Reflections</u>

The Therme Vals

This design differs from other examples with its ability to appeal to the five senses. Bilgin (2019: 15-18) explains the appeal to the five senses in this structure as follows:

Ancak bu kez istiflenen malzeme Alpler'in ahşabı değil taştır. Hamam bu gri-mavi taştan ve suyun sıvı ve buhar hallerinden ibarettir. Taşlar aynen doğada buldukları tektonik katmanlar halinde üst üste dizilmiş ve duvarlar taşların dikine kesitini görünür kılacak şekilde istiflenmiştir. Taş ve sudan ibarettir dedik ama esasen duyulara dokunmaktan ibarettir de diyebilirdik. Çünkü taş ve su duyuları manipüle etmek üzere ve görme dışındaki duyulara doğrudan temas etmek üzere kullanılıyor. Kapalı havuzdan yüzerek geçilen, suyla dolu mağaramsı kuytu odada suyun üzerinde yasemin çiçekleri yüzmeye bırakılmış. [However, this time the stacked material is not the wood of the Alps, but the stone. The bath consists of this gray-blue stone and the liquid and vapor states of the water. The stones were stacked on top of each other in the same tectonic layers as they were found in nature, and the walls were stacked in such a way as to make the vertical section of the stones visible. We said it consisted of stones and water, but we could have said that it consisted mainly of touching the senses. Because stone and water are used to manipulate the senses and to directly contact the senses other than sight. Jasmine flowers were left to float on the water in the cave-like nook filled with water, where you can swim through the indoor pool]. (Bilgin, 2019: 15-18)

Bilgin (2019: 15-18) mentioned the existence of three physical states of water in the selected example and its appeal to the senses of sight and touch. After the explanations above, Bilgin drew attention to the sound, taste, and smell of water in the space as follows:

Bütün duvarlardan "taş ve su" temalı Zumthor'un çevresinden bir besteci tarafından bestelenmiş müziğin sesi geliyor. Binlerce damlanın çeşitli yüksekliklerden düşerek taşa temas edişinin yankıları bu sesler ve bu seslerden başka hiç uyarıcı yok bu kuytu odada [The sound of music composed by a composer around Zumthor with the theme of "stone and water" comes from all the walls. These sounds are the echoes of thousands of drops falling from various heights and touching the stone, and there is no stimulus other than these sounds in this secluded room]. (Bilgin, 2019: 15-18)

Kuytu odalardan birinin ortasında da kaynak suyun serini var. İri bir borudan çağıl çağıl yerlere akıyor. Bu kez yıkanmak, dokunulmak için değil içilmek, yani tadılmak için. Su ve taş koklandıktan, dokunulduktan, işitildikten sonra bir de tadılmış oluyor. Böylelikle tatma duyusu da tecrit edilerek uyarılmış oluyor [There is a cool spring water in the middle of one of the secluded rooms. It flows cascading down a large pipe to the ground. This time, not to be washed, touched, but to be drunk, that is, to be tasted. After smelling, touching and hearing the water and the stone, it is also tasted. In this way, the sense of taste is also isolated and stimulated]. (Bilgin, 2019: 15-18)

Dikkat edilirse bir tek görme duyusu yok ki, o da Zumthor için en kolay vazgeçilebilir duyu. Çünkü görme bu dünyanın egemen duyusu: Dışarıda her şey görme odaklı değil mi zaten? [Note that there is not only one sense of sight, which is the most dispensable sense for Zumthor. Because sight is the dominant sense of this world: Isn't everything out there focused on sight anyway?]. (Bilgin, 2019: 15-18)

First of all, when the sensory features of water in the architectural space are examined in the above statement, the determined word is underlined: Senses. The reason why this word is chosen as a sensory feature is due to the directly related to all senses. Besides the sensory features, when the perceptual features of water in the architectural space are examined in the above statement, the determined words are underlined: Contact and Eco. When these two situations are combined, the words chosen from the statements for the conceptualization of water through space are Senses, Contact and Echo (Table 13). These selected words support both the relationship of water with space and the concepts that can be considered in common with the pure appearance of architecture.

Table 13. Sensory and perceptual features of water in the Therme Vals

Statement Type	Thematic Concepts
Some explanations by İhsan Bilgin (Master Architect, Academician, Professor of Architecture, Dean, Writer) in his book named "Mimarın Soluğu"	Senses Contact Eco

Fallingwater

Donald Hoppen has the following description of the building:

Wright's apprentice Donald Hoppen has spoken of Wright's "uncanny sense of...genius loci" (Latin for "spirit of the place") and from the very beginning, the architect rejected a site that presented a conventional view of the waterfall; instead, he audaciously offered to make the house part of it, stating that the "visit to the waterfall in

the woods stays with me and a domicile takes shape in my mind to the music of the stream.” The South-southeast orientation gives the illusion that the stream flows, not alongside the house, but through it. (Wiebe, n.d.)

In an interview on YouTube, Wright said about Fallingwater:

There was a rock ledge bank beside the waterfall and the natural thing seemed to be to cantilever the house from the rock bank over the fall, and The Bear Run house came into possession of concrete and steel of which to build a house and of course the grammar of that house geared up on that basis and of course Mr. Kaufmann’s love for a beautiful site. He loved the side where the house was built, and he liked to listen to the waterfall, so that it was a prime motive in the design. I think you can hear the waterfall when you look at the design. At least it’s there, and he lives independently with the thing he loved. (Manufacturing Intellect, 2019)

First, when the sensory features of water in the architectural space are examined in the above statement, the determined word is underlined: Hearing. The reason why this word is chosen as a sensory feature is due to the directly related to sound. Besides the sensory features when the perceptual features of water in the architectural space are examined in the above statement, the determined words are underlined: Part of Waterfall and Illusion. When these two situations are combined, the words chosen from the statements for the conceptualization of water through space are: Music of the Stream, Illusion, Hearing (Table 14). These selected words support both the relationship of water with space and the concepts that can be considered in common with the pure appearance of architecture.

Table 14. Sensory and perceptual features of water in Fallingwater

Statement Type	Thematic Concepts
Donald Hoppen’s (Wright’s apprentice) description in an Essay by Charles Wiebe	Hearing
Interview with Frank Lloyd Wright (Architect of the Building) on YouTube	Part of Waterfall Illusion

Pulitzer Arts Foundation at St. Louis

Since there is no text of Ando related to this example, it has been tried to go through a thesis.

The museum is inwardlooking, or even secretive. What one can see from outside are horizontal rectangular masses, concrete walls, and small openings. On the south side is a peaceful water area extending to the skyline of the city in the distance; on the east side is the exhibition zone with the highest ceiling. The lobby is a concrete box connecting two long building parts, and its large windows face southwest to the water surface. Water is always an important architectural element for Ando. Just like Ando’s other works, the Pulitzer Foundation for the Arts has its own nature. Between two concrete boxes, there is a narrow rectangular artificial pond, opening to the southwest. After taking a U turn from the entrance gate, there is a curtain wall, through which one may have the whole view of the pond. As the pond is enclosed by three concrete boxes, in most of times the pond is peaceful. The peaceful pond is how Ando achieves the abstract from the nature: light comes to the interior space through the curtain wall; water is still on the pond; and the sky is reflected by the water. (Jiang, 2019: 14-18)

First, when the sensory features of water in the architectural space are examined in the above statement, the determined word is underlined: View. The reason why this word is chosen as a sensory feature is due to the directly related to image. Besides the sensory features, when the perceptual features of water in the architectural space are examined in the above statement, the determined words are underlined: Peaceful and Reflection. When these two situations are combined, the words chosen from the statements for the conceptualization of water through space are: View, Peaceful, Reflection (Table 15). These selected words support both the relationship of water with space and the concepts that can be considered in common with the pure appearance of architecture.

Table 15. Sensory and perceptual features of water in Pulitzer Arts Foundation at St. Louis

Statement Type	Thematic Concepts
Some explanations by Cunbei Jiang (Master Architect) in his Master Thesis	View Peaceful Reflection

Church on the Water

In the catalog published by MOMA, Frampton wrote about the building:

The wall behind the altar is constructed entirely of glass, affording a dramatic panorama of the pond with a large cross set into the water. The glass wall itself, spanned by a cruciform mullion, can slide to the side, like a giant shdji screen, opening the chapel toward nature. (Frampton, 1991: 34)

In the the book titled “Boyut Çağdaş Mimarları Dizisi 6 - Tadao Ando”, C. Abdi Güzer cited the Ando's statement about the building:

Bu projede yakındaki bir dereden su alınarak yapay bir göl oluşturuldu. Doğanın bir parçası olan suyun mimarlıkla ve insanlarla ilişkisi üzerine düşünmeye başladım. [In this project, an artificial lake was created by taking water from a nearby stream. I started to think about the relationship of water, which is a part of nature, with architecture and people]. (Güzer, 2000: 36)

Uzun duvar boyunca yapıya yaklaşıldığında derenin sesini duyuyor fakat onu göremiyorsunuz, heyecan yükseldikçe duvardaki bir açıklıktan içeri giriliyor ve 180 derece dönülerek suyla karşılaşılıyor. Su sesini dinleyerek yumuşak bir tepeye tırmanırken, dört bir tarafı cam duvarlarla kaplı bir mekana yöneliniyor. [When you approach the building along the long wall, you can hear the sound of the stream, but you cannot see it. As the excitement rises, one enters through an opening in the wall and turns 180 degrees to come across water. While climbing a soft hill listening to the sound of water, you head towards a place covered with glass walls on all four sides]. (Güzer, 2000: 36)

Burada insan suyun, rüzgarın ve kuşların seslerini dinleyerek doğayla iletişim kuruyor. Ben izleyicilerin sadece gözlerine değil tüm duyuvarına hitap eden bir mimari yapmak istedim. [Here, people communicate with nature by listening to the sounds of water, wind and birds. I wanted to make an architecture that appeals not only to the eyes of the audience, but also to all their senses]. (Güzer, 2000: 36)

Şapelin önündeki suyun yüzeyi çevrenin muhteşem doğası içinde soyut bir ayna yüzeyi gibi uzanıyor. Manzara günün saatlerine göre değişiyor ve suda yansıyor. [The surface of the water in front of the chapel stretches out like an abstract mirror surface in the magnificent nature of the surroundings. The landscape changes according to the time of day and is reflected in the water]. (Güzer, 2000: 37)

First, when the sensory features of water in the architectural space are examined in the above statement, the determined word is underlined: Dramatic Panorama. The reason why this clause is chosen as a sensory feature is due to the directly related to image. Besides the sensory features, when the perceptual features of water in the architectural space are examined in the above statement, the determined words are underlined: Communication and Reflection. When these two situations are combined, the words chosen from the statements for the conceptualization of water through space are: Dramatic Panorama, Communication, Reflection (Table 16). These words support both the relationship of water with space and the concepts that can be considered in common with the pure appearance of architecture.

Table 16. Sensory and perceptual features of water in Church on the Water

Statement Type	Thematic Concepts
Some explanations by Kenneth Frampton (Architect, Critic and Historian) in the catalog published by MOMA	Dramatic Panorama Communication Reflection

DISCUSSION

In this section, all the findings were tried to be connected by emphasizing the inferences obtained with a biophilic design approach, why these findings were traced, and the reflections of the relations between concept and mass on nature and water. In this context, a comparison was made between the analyzed examples, emphasizing their similarities and differences regarding the final perceptual result.

Reading results according to the first method were combined in Table 17. The sensory features of water in selected buildings were evaluated according to the five senses decided based on YouTube videos. The same sensory features of water were determined in Fort Worth Water Gardens, in Smithsonian Institution Courtyard, in Apple Piazza Liberty, in Fallingwater and in Church on the Water (Table 17). On YouTube videos, while

information about “Sound”, “Image” and “Tactile Texture” features can be determined from the experience of people in the space, precise information about “Smell” and “Taste” features could not be accessed for these buildings (Table 17). Apart from the Pulitzer Arts Foundation in St. Louis, the “Sound” feature was determined in 6 other selected architectural designs. “Image” feature was determined in all seven selected architectural designs. Apart from the Pulitzer Arts Foundation in St. Louis, the “Tactile Texture” was determined in 6 other selected architectural designs. Apart from The Therme Vals, the “Smell” and “Taste” feature was not determined in 6 other selected architectural designs (Table 17). All sensory features of water were determined in The Therme Vals (Table 17). On YouTube videos, “Sound”, “Image” and “Tactile Texture”, “Smell” and “Taste” features was determined from the experience of people in the space for this building (Table 17). So, this building was different from the others. Only one feature of water was determined in Pulitzer Arts Foundation at St. Louis (Table 17). On YouTube videos, while information about “Image” feature was determined from the experience of people in the space, precise information about “Sound”, “Tactile Texture”, “Smell” and “Taste” features could not be accessed for this building (Table 17). In this case, The Therme Vals stood out by showing that all sensory features were experienceable, while the Pulitzer Arts Foundation at St. Louis showed that only one sensory feature was experienceable.

Table 17. Sensory features of water in selected buildings

Selected Example	Sensory Features of Water				
	Sound	Image	Tactile Texture	Smell	Taste
Fort Worth Water Gardens, Philip Johnson and John Burgee	+	+	+	-	-
The Robert and Arlene Kogod Courtyard at the Smithsonian Institution, Foster and Partners	+	+	+	-	-
Apple Piazza Liberty Foster and Partners	+	+	+	-	-
The Therme Vals Peter Zumthor	+	+	+	+	+
Fallingwater Frank Lloyd Wright	+	+	+	-	-
Pulitzer Arts Foundation at St. Louis Tadao Ando	-	+	-	-	-
Church on the Water Tadao Ando	+	+	+	-	-

Reading results according to the second method were combined in Table 18. The sensory and perceptual features of water in selected buildings were evaluated according to the statements. Three concepts were obtained from the statements obtained for each selected building (Table 18). A total of 21 concepts were determined by thematic reading (Table 18). Relationships between these 21 concepts and exemplary spaces were tried to be established through the element of water in Table 18. At the same time, concepts were discussed reflections of the relations between analyzed examples of nature and water. The effect of the presence of water in a place on stress, cognitive performance, emotion, mood, preferences was a theme of nature-related design and interaction between humans and nature in biophilic design. This information was consistent with the results obtained in this study.

“Contact” concept for The Therme Vals, “Part of Waterfall” concept for Fallingwater, “Communication” concept for Church on the Water were shown that these architectural designs were part of nature. From this point of view, it could be stated that these architectural designs can increase the relationship between humans and nature. It also supported being close to nature based on the definition of Kellert and Wilson’s (1993) as “a human dependence on nature that extends far beyond the simple issues of material and physical sustenance” and Kellert’s (2005) as biophilic design as the instinctive connection of people with the natural world.

“Calm” and “Noise” concepts for Fort Worth Water Gardens, “Multisensory” and “Disappearing” concepts for The Robert and Arlene Kogod Courtyard at the Smithsonian Institution, “Infinitely Reflections” concept for Apple Piazza Liberty, “Peaceful” concept for Pulitzer Arts Foundation at St. Louis were shown that these architectural designs could be related emotions and moods because of effect the sensory perception.

All selected words for the examples support both the relationship of water with space and the concepts that could be considered in common with the pure appearance of architecture. “Endless” concept for Fort Worth Water Gardens, “Curling” and “Plane” concepts for The Robert and Arlene Kogod Courtyard at the Smithsonian Institution, “Kaleidoscopic Effect” concept for Apple Piazza Liberty, “Contact” and “Eco” concepts for The Therme Vals, “Part of Waterfall” and “Illusion” concepts for Fallingwater, “View” and “Reflection” concepts for Pulitzer Arts Foundation at St. Louis, “Dramatic Panorama” “Communication” and “Reflection” concepts for Church on the Water were shown that there was a connection between these water features and these architectural designs of the masses.

Table 18. Conceptualization of water in selected buildings

Selected Example	Concepts	Figures
Fort Worth Water Gardens, Philip Johnson and John Burgee	Noise Endless Calm	
The Robert and Arlene Kogod Courtyard at the Smithsonian Institution, Foster and Partners	Curling Plane Disappearing	
Apple Piazza Liberty, Foster and Partners	Multisensory Kaleidoscopic Effect Infinitely Reflections	
The Therme Vals, Peter Zumthor	Senses Contact Eco	
Fallingwater, Frank Lloyd Wright	Hearing Part of Waterfall Illusion	
Pulitzer Arts Foundation at St. Louis, Tadao Ando	View Peaceful Reflection	
Church on the Water, Tadao Ando	Dramatic Panorama Communication Reflection	

CONCLUSION

In this study, the field studies carried out above resulted in the acquisition of concepts arising from some statements and videos. It was observed that the concepts obtained from the statements intersect in the selected architectural examples, both in water use and the characteristic architectural line of the building. From the statements obtained, this compatibility between both the water and the characteristic elements of the building was conceptualized. The multidimensional linear oasis design in the Fort Worth Water Gardens could connect one of its concepts, “Endless”; the wavy glass-steel and the fluid-form of the roof design in the Robert and Arlene Kogod Courtyard at the Smithsonian Institution could connect one of its concepts “Curling”; the glass ceiling and fountain’s wall design in the Apple Piazza Liberty could be connect one of the its concepts “Kaleidoscopic Effect”; the half buried into the hillside design in The Therme Vals could connect one of its concepts “Contact”; the planes and relationship of layers design in Fallingwater could connect one of the its concepts “Part of Waterfall”; the design of the canyon-like walls in Pulitzer Arts Foundation at St. Louis could connect one of its concepts “Peaceful”; the partly designed onto the pond the Church on the Water could connect one of its concepts “Communication”. From this point of view, it could be stated that there was a connection between the sensory and perceptual aspects of the water in the buildings and the concepts obtained with the biophilic approach from the statements of the author architects.

According to 14 Models of Biophilic Design (2014), the presence of water enriches a place’s experience through seeing, hearing, or touching the water. In addition to this situation, it was identified from the findings that experience a place through smelling and tasting the water in The Therme Vals. Therefore, when the other smelling and tasting experiences were added to this seeing, hearing or touching experiences, and in this context, the presence of water could enrich the experience more. On the other hand, within the scope of biophilic design, besides the use of water as an element in the space, it was observed that water was also reflected in the building architecture. In addition to the physiological and psychological effects of the presence of water in the space, it was observed that it was a phenomenon that also shapes architectural design decisions. As a result, it was concluded that sensory perception of the water features in the architectural space can affect human psychology within the scope of the biophilic design, architecture and author architects’ relationship in this study. From this point of view, the ways of perceiving water in contemporary architectural examples that could be given as examples of biophilic design and determined concepts were found to be related.

Authors' Contributions

The authors contributed equally to the study.

Funding and Acknowledgements

This study is an output of the research project entitled “Biyofilik Yaklaşım ile Suyun Mekânda Algısal ve Duygulanımsal Boyutları: Çağdaş Mimarlık Örnekleri” which has been supported by The BAP Coordination Unit of Fatih Sultan Mehmet Vakıf University. The number of the research project is 2022B1Ç05D. The authors would like to thank the (Scientific Research Projects) BAP Unit of Fatih Sultan Mehmet Vakıf University.

Competing Interests

There is no potential conflict of interest.

Ethics Committee Declaration

This study does not require ethics committee approval.

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- Figure 7:** Wolfe, J. (2008). *Church on the Water*. (The photo is used with the special permission from Jason Wolfe) www.flickr.com/photos/jswolfe/2959854905/in/album-72157608235514578/ (04.10.2022).

Author's Biography

Damla Katuk continues her master thesis under the supervision of Assoc. Prof. Dr. Emine Köseoğlu with full scholarship in the Master of Architecture Program at Fatih Sultan Mehmet Vakif University. She is a visiting lecturer and design studio instructor at Yıldız Technical University Faculty of Architecture Department of Architecture in Introduction to Architectural Design, Architectural Design 1 and Aquarelle Technique courses. She continues to develop her conceptual and experimental works on subjects such as watercolour, ink, sketch, illustration, design, architectural space, and Franz Kafka's literary works. She organizes various workshops, seminars, and exhibitions at universities.

Emine Köseoğlu graduated from the Department of Architecture at Trakya University in 2002. With her thesis on cross-cultural spatial perception in hotel lobbies, she graduated from Yıldız Technical University, Department of Architecture in 2004; completed her Ph.D. research in 2012 on formal, subjective and syntactical spatial legibility at YTU; and received the title of Associate Professor in April 2018. Her main research areas are architectural design, environmental psychology, and urban morphology, where she focuses on spatial cognition, spatial perception, spatial legibility, environmental image, architectural phenomenology, literary space, destination image, tourist behavior, literary tourism, design/architectural education, culture-space relations, space syntax.