HUMAN RESPONSES TO WATER ELEMENTS IN INTERIOR ENVIRONMENTS: A Cultural and Gender Comparison

BY

GWO-FANG LIN

A dissertation submitted in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY
Individual Interdisciplinary Doctoral Program

WASHINGTON STATE UNIVERSITY
The Graduate School

MAY 2002

© Copyright by GWO-FANG LIN, 2002
All Rights Reserved
ACKNOWLEDGEMENT

Many people have contributed to make this study possible. I thank all the members of my committee, Dr. Louis Gray, Dr. Loren Lutzenhiser, Dr. Nancy McKee, Prof. Sarah Recken, Dr. Jo Ann Thompson, and Dr. Amy Wharton for their enduring support and great guidance. I specially thank Dr. Thompson, my advisor, for her patiently guided the dissertation through far too many drafts. Her quiet urgings and careful reading of all of my writing will never be forgotten.

Thanks to Dr. Joan Anderson, Prof. Robert Krikac, Jeffrey Lee, Dr. Nancy McKee, Hsueh-Ping Meier, and Dr. Carol Salusso helped to find student subjects. Thanks to those 400 students who were willing to participate in the experiment. Thanks to Jeffrey Lee a dear friend who supported and helped me through the entire process of the experiment. Thanks to Colin Sachs kept me employed throughout my graduate studies.

Finally, a heart felt thanks to my dearest parents, my sister, and my wife Yi-Chun for their endless love, encouragement, support, and unwavering faith in me.

Without every one of you and your support this dissertation would not have been written.
HUMAN RESPONSES TO WATER ELEMENTS IN INTERIOR ENVIRONMENTS:
A Cultural and Gender Comparison

Abstract

by Gwo-Fang Lin, Ph.D.
Washington State University
May 2002

Chair: Jo Ann Asher Thompson

Objective

The purpose of this study is to examine human responses to water features used in interior environments and to explore the inter-relationships between interior water features and people, gender, and culture.

Research Methodology

College students from the United States and Taiwan completed photo questionnaires of interior environments with a water feature emphasized and interior environments without a water feature emphasized. Based on the subjects’ responses to the photographic images, a preference score (dependent variable) was determined by counting the number of preference marks made in the photographs where water was emphasized.

Analysis

Three-way analysis of variance (ANOVA) and t tests was used to determine
whether there was a significant relationship between culture and gender responses to water features in public interior environments.

**Key Findings**

An overall higher preference level for images of interior environments that emphasized a water feature was found than for interior environments that did not. Contrary to expectations, the presence of real water flowing and gender had no significant effect on the subject’s preference for the images that emphasized water. Additional findings showed that subjects from the United States had a higher preference for interior environments that included water than Taiwanese subjects.

**Conclusion**

This study supports the notion that the use of water as a design feature is a powerful element that can be used to enhance interior spaces. However, the study suggests that designers should not assume that all people respond to water features in interior spaces in the same way and at the same level. The study further suggests that the creators of designed environments should carefully address the following questions when deciding whether or not to incorporate a major water feature: 1) who are the planned occupants of the designed space, 2) what genders will predominantly interact with the designed space, and 3) What is the cultural background of the users of the designed space?
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>viii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>ix</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Purpose of the Study</td>
<td>4</td>
</tr>
<tr>
<td>Dissertation Structure</td>
<td>5</td>
</tr>
<tr>
<td>2. HUMAN RESPONSES TO WATER ELEMENTS IN INTERIOR ENVIRONMENTS</td>
<td>7</td>
</tr>
<tr>
<td>Introduction</td>
<td>9</td>
</tr>
<tr>
<td>Literature Review</td>
<td>11</td>
</tr>
<tr>
<td>Methodology</td>
<td>16</td>
</tr>
<tr>
<td>Conclusion</td>
<td>25</td>
</tr>
<tr>
<td>References</td>
<td>30</td>
</tr>
<tr>
<td>3. AN EXAMINATION OF CULTURAL AND GENDER PREFERENCES FOR THE USE OF WATER FEATURES IN INTERIOR ENVIRONMENTS</td>
<td>32</td>
</tr>
<tr>
<td>Introduction</td>
<td>33</td>
</tr>
<tr>
<td>Review of Literature</td>
<td>35</td>
</tr>
</tbody>
</table>
Methodology ................................................................. 39

Analysis and Findings ..................................................... 43

Conclusions ................................................................... 46

References .................................................................... 51

4. SUMMARY .................................................................. 53

References .................................................................... 56

APPENDIX

A. VERBAL CONSENT SCRIPT .............................................. 58

B. PHOTO QUESTIONNAIRE ................................................ 60
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The Overall Experiment Design</td>
<td>18</td>
</tr>
<tr>
<td>2.</td>
<td>Mean Preference Score and Standard Deviation</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>$t$-test of Overall Mean $= 2$ (null hypothesis of indifference)</td>
<td>21</td>
</tr>
<tr>
<td>4.</td>
<td>Tests of Between-Subjects Effects</td>
<td>22</td>
</tr>
<tr>
<td>5.</td>
<td>The Overall Experiment Design</td>
<td>41</td>
</tr>
<tr>
<td>6.</td>
<td>Mean Preference Score and Standard Deviation</td>
<td>43</td>
</tr>
<tr>
<td>7.</td>
<td>$t$-test of Gender Difference among US Subjects</td>
<td>44</td>
</tr>
<tr>
<td>8.</td>
<td>$t$-test of Gender Difference among Taiwanese Subjects</td>
<td>44</td>
</tr>
<tr>
<td>9.</td>
<td>$t$-test of Cultural Difference</td>
<td>45</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Effect of Gender on the Preference Score by Culture (with real water flowing in the test room)</td>
<td>23</td>
</tr>
<tr>
<td>2. Effect of Gender on the Preference Score by Culture (without real water flowing in the test room)</td>
<td>23</td>
</tr>
</tbody>
</table>
Dedication

This dissertation is dedicated to my mother and father

who provided both emotional and financial support
CHAPTER ONE
INTRODUCTION

Water is the most common substance on Earth, covering more than 70% of the planet's surface. Water was regarded by ancient philosophers as one of the four basic elements of the universe along with earth, air, and fire and, according to the literature, water is a symbol for life (Moore, 1994).

The location of water has helped to determine where humans settle and grow crops for food. The human body is about two-thirds water and without water the longest any human can expect to live is 10 days. This life-giving substance has played an important role in the religion, literature, and art of every culture. For example, the ancient Greeks had springs where only the immortal gods were privileged to imbibe (Moore, 1994) and, in Christianity, the Bible makes frequent mention of the mystical and religious powers associated with water; e.g., “A river flowed out of Eden to water the garden, and there it divided and became four rivers” (Genesis 2:10).

The simple, yet interesting, physical characteristics of water stimulate our senses, and the mental connections these help us make. According to the literature, these connections are important and can also be used to create experientially rich and meaningful places. Almost unanimously, studies have shown that water is one of the most powerful elements in enhancing preferences of humans (e.g., Brush & Shafer, 1975; Civco, 1979; Hammit, 1987; Kaplan & Kaplan, 1982; Palmer, 1978; Penning-Roswell, 1979; Shafer, Hamilton, & Schmidt, 1969; Syme & Nancarrow, 1992; Ulrich, 1981; Yang & Brown, 1992; and Zube, Pitt & Anderson, 1975). For instance, in Yang and
Brown’s study in Korea the characteristics of preferences for three landscape elements—water, vegetation, and rock—were analyzed. The main purpose of the study was to compare the characteristics of preferences for a group of Korean citizens and Western tourists, with special emphasis on the general patterns of preference and the relationships of landscape preference to landscape styles and elements. The research results showed that water was the most preferred landscape element, regardless of the cultural differences of the people (Yang & Brown, 1992).

In another study by Hammitt, seven hundred and fifty hikers of the National Park Service trail were surveyed for their ability to recognize trail scenes after hiking the trail environment. As a result, Water and Trail Disturbance had the highest mean familiarity ratings from the four factors (Hammitt, 1987).

More evidence of the strong connections between people and water is provided by a study by Syme & Nancarrow. This longitudinal study was done to assess the level of demand and the motivations for participating in urban water planning in three Australian cities. The research concluded that there is a strong demand for involvement in water-related planning (Syme & Nancarrow, 1992).

**Water and Humankind**

Water has a special significance to human kind. It carries ingredients vital for human life, and is essential for growing our food (Brown, 1997). Throughout time, special meanings have been associated with water. For example, the symbols associated with water are those of life, purity, fertility, security, hospitality, and communion with God (Douglas, 1970). On one hand, water has a physical hold on the lives of every one of
us, while on the other hand, water also carries mental images that have meaning for us; for example, from birth in the amniotic fluid to death in the mythical waters of the river Styx (Moore, 1994).

In addition to water’s association with special meanings and symbols, the literature cites the basic human need to be close to—and feel part of—nature. For instance, according to Fitzsimmons & Salama, a water-related recreation facility can help improve the physical and mental health of the users (Fitzsimmons & Salama, 1977). Several studies have shown that water has a positive therapeutic effect. Alexander argued that going into the water might bring a person closer to the unconscious process in one’s life and bring them closer to their dreams (Alexander, 1977). In psychoanalysis, it is common to consider the appearance of water in people’s dreams as associated with special meanings. Jung and the Jungian analysts consider the great bodies of water as representing the dreamer’s unconscious.

For many of us, water has a great attraction. People often visit places with water. For example, rivers, lakes, waterfalls or swimming pools are regular features of many people’s lives. Water touching our skin is the most personally intimate experience we can have. Degrees of contact range from being misted by warm steam, to being splashed by a waterfall, to being completely immersed in a bath. Immersion is a kind of escape or disconnection from the world outside the water (Brown, 1997).

**Water and the Built Environment**

Landscape architect Robert K. Murase says, “Just building a simple stone wall, with a drainage swale next to it, is a powerful element. It’s nothing more than that, but
kids can play in the water, sit on the wall, walk along the path that marks the edge. These simple human elements added to the landscape make it engaging” (Leccese, 1997).

Built environments and water engage us by letting us see, hear, and touch the water in a variety ways. Sight, sound, and contact characterize all the places we have seen. Moore argues, if we can effectively incorporate water’s symbolism, history and physical nature, then our water and architecture can have a potential for wonder unmatched by any other material that we can include in our environments (Moore, 1994). Moore’s theory is supported by the work of Julian Jones who examined the influences of water on architecture by outlining the physical and chemical characters of the nature of water and how these are used to enhance the quality of life (Toy, 1994). The literature supports the idea that through the careful arrangement of water and architecture, we can create a pleasing place.

**Purpose of the Study**

Today, from shopping malls, to hotel lobbies, to fish tanks in our living rooms, water continues to be used throughout our interior environments. Does the use of water in interior spaces elicit positive human responses, as the literature seems to indicate? Does the use of water in interior spaces have different meanings depending on gender and cultural orientation?

These questions are not easily answered and depend upon many variables. In an earlier exploratory study by Lin, water features in ten public interior spaces were examined (Lin, 1999). The purpose of the study was to examine human responses to water-featured design elements in public interior spaces and to determine the extent to
which people modify their behavior as they move through public spaces where water features are included. However, the results were inconclusive and served as the inspiration for further examination of the relationships among culture, gender, and water.

Since design is an interdisciplinary field that often reflects the aesthetic, social, culture, and political background of our society, an interdisciplinary approach to further exploration allowed the researcher to examine more closely the inter-relationships between water elements in designed environments and people, gender, and culture. The literature from environmental and behavioral research was explored and provided the theoretical and methodological grounding for the study. Theories, methodologies, and problem-solving approaches, drawn from subject matter areas and disciplines of interior design and architecture, in conjunction with the social, environmental, and behavioral sciences, provided a full context for the study of human relationships to, and with, designed and built environments. Through the incorporation of information from these various perspectives, a better understanding of those things that most impact human responses to water in designed environments was gained.

**Dissertation Structure**

The dissertation was written in a manuscript format, which includes four chapters. Chapter One consists of a general introduction and Chapter Two includes the first article: *Human Responses to Water Elements in Interior Environments*. Chapter Three includes the second article: *An Examination of Cultural and Gender Preferences for the Use of Water Features in Interior Environments* and Chapter Four includes an overall summary.
The first article was prepared for submittal to the *Journal of Interior Design* and the purpose was to examine the inter-relationships between interior water features and people in general. The second article was prepared for submittal to the *Environment and Behavior* journal and was more focused on the culture and gender differences in response to water features in interior environments. *The Publication Manual of the American Psychological Association* (fourth edition) was used for general guidelines. Formatting requirements differed slightly between the two journals.
CHAPTER TWO

HUMAN RESPONSES TO WATER ELEMENTS IN INTERIOR ENVIRONMENTS

Objective

The purpose of this study is to examine human responses to water features used in interior environments and to explore the inter-relationships between interior water features and people, gender, and culture.

Research Design

A sample of 400 college students from the United States and Taiwan completed photo questionnaires of interior environments that incorporated a water feature and interior environments that did not incorporate a water feature. Half of the subjects completed the photo questionnaire in a room setting that included a water fountain with real water flowing and half completed the questionnaire in a room setting without a water fountain and real water flowing.

Key Findings

An overall higher preference level for images of interior environments that emphasized a water feature was found than for interior environments that did not. Contrary to expectations, the presence of real water flowing had no significant effect on the subject’s preference for the images that emphasized water. Additional findings showed that female subjects, regardless of cultural background had a higher preference for interior environments with water than male subjects; and that subjects from the United States had
a higher preference for interior environments that included water than Taiwanese subjects.

**Conclusions**

Overall, the fact that the subjects, regardless of gender or culture, preferred interior images where water features were emphasized supports the literature that suggests people’s experiences are enhanced by the presence of water. Additionally, the study supports the idea that women are more sensitive to their surrounding environment and, regardless of cultural background, had a significantly higher preference level for images of interiors with water emphasized than male subjects. Given that water-featured design is expensive to install and maintain, this study provides designers with important information about how people of different genders and cultures respond to water features in interior environments, thereby allowing design decisions about the use of water in interior environments to be based on fact, rather than assumption.
Introduction

People often say that water makes them feel relaxed or that water can enhance the living environment. In recent years a variety of small to large-scale water fountains for living environments have flooded the marketplace. Retailers and companies extol the virtues of having a fountain in your living environment. For example, it is promoted that a fountain in your living environment creates an ambiance of relaxation, sets your mind at ease, and refreshes your senses. According to these marketing tactics, fountains can also take you away to a distant place, improve your concentration, rest your body, and restore the balance between your mind, body, and soul.

Although the idea of the inclusion of a water feature in an interior environment is generally accepted as a positive design element, a recent exploratory study showed that people’s physical response to the use of water features in public interior environments was very low. Another surprise from the study was that male subjects tended to respond to water features more frequently than female subjects (Lin, 1999).

Gender, and the way it is interpreted by different social and cultural groups, is an extremely powerful component of our everyday lives. Does the use of water in interior environments convey different meanings and messages depending on gender? Do people with diverse cultural backgrounds respond to water features in interior environments differently?

It was the intent of this study to examine and explore the inter-relationships between water features in interior environments and people, gender, and a specific culture. Since water has played an important role in Taiwanese culture, one aspect of this study was to examine the cultural differences between Taiwanese and American
preferences for the use of water features in interior environments. Because results from previous research on gender difference and preference for the use of water features in interior environments was inconclusive, this study further examined men and women’s preferences in more depth and was designed to examine and challenge preconceived notions about the use of both the image of water and real water when incorporated into interior environments.

It is anticipated that through this study much can be learned about the reality of the use of water features in interior environments and the impact on human behaviors in such settings. Given that water-featured design is expensive to install and maintain, this study will provide designers with important information about how people respond to water features in interior environments, thereby allowing design decisions about the use of water in interior environments to be based on fact, rather than assumption.
Literature Review

Water and Humans

Water has played an important role in the religion, literature, and art of every culture, and throughout time special meanings have been associated with water. For example, ancient philosophers regarded water as one of the four basic elements of the universe along with earth, air, and fire and, according to the literature, water is a symbol for life (Moore, 1994).

Through the ages water has been used as a design element in a multitude of ways, presenting a complexity and interweaving of function and symbolism (Campbell, 1978). Some modern artists and designers have used water as a source of inspiration or as a major design element. For instance, Claude Monet spent his final years painting impressions of the transcendent water pond that resulted in the water lily series with the intention of bequeathing his last peaceful opus to the people of France (Moore, 1994) and Frank Lloyd Wright, in the Hollyhock House in Los Angeles, used water throughout the house to create specific moods.

Our associations with water today have been shaped by our ancestors, so that the lapse of centuries adds to the symbolism (Moore, 1994). Campbell wrote, “I seriously doubt that any of the sounds created by water could be considered distressing or annoying” (Campbell, 1978). The effectiveness of the audio element of water is demonstrated in the design of the Hospital Santa Engracia in Monterrey, Mexico, where a sunken fountain is used to mask street sounds (Tetlow, 1997). A design enhancement such as a decorative fountain with splashing water not only enhances an interior’s appearance, but also can serve as a way finding device. In this case, the sound of the
fountain gives people orientation cues (Patterson, 1997). In addition to these qualities, designers have used water for its reflection properties to provide depth and to take advantage of the infinite surface of water for relief of claustrophobia and expansion of personal space (Moore, 1994).

The human relationship with water involves understanding not only environmental behavior but also our biological roots. It is a central contention of anthropology that humans are different by culture, but fundamentally the same by nature. Our DNA takes the form of innate propensities, things we do unthinkingly and without having to learn from our parents. For example, regardless of culture differences, humans seem to be biologically prepared to look for very specific cues about the natural world. Biologists believe that the way our ancestors lived has shaped our DNA. The strings tying us to our past may stretch back more than 2 million years.

During the evolution of time, it is believed that humans recognized certain features of the landscape as offering greater chances for survival (Conniff, 1999). In addition to providing a physical necessity for survival, bodies of water also provided a defense from most natural enemies and it attracted other animals and plant life on which humans depended.

Through time, there is no doubt that the meaning of water has grown and developed along with many different human cultures. Research across many disciplines supports the hypothesis that there is a fundamental basic human need to connect closely with nature. This condition is known as biophilia. If this biophilia hypothesis has merit, it provides a framework across different disciplines for the investigation of the meaning of water and the human relationships with it (Kahn, 1999).
In addition to the theory of biophilia, the involvement theory also helps to explain why water elements may enhance people’s preferences for specific environments. Goffman claimed that humans and animals have a capacity to divide their attention into main and side involvements. A main involvement is the major part of one’s attention and interest, visibly forming the principal current determinant of his or her actions. A side involvement is an activity that an individual can carry on in an abstracted fashion without interrupting or confusing the main involvement. For example, singing while working and knitting while listening (Goffman, 1963).

In the involvement theory the use of a water feature in an environment serves the human need for a side involvement. Whether a main involvement is present or not, people in a public space sustain at least a certain minimal main involvement to avoid the appearance of being totally disengaged (Goffman, 1963). This is one reason why waiting rooms and airplanes often are supplied with magazines and newspapers. This reasoning also applies to the use of water features in such places as parks, waiting areas, and lobbies. The use of water features in these environments play an important role, providing a source of minimal involvement to fulfill this basic human need.

The use of water features in our built and natural environments has been of long-standing interest to researchers. There are several studies that have examined the use of water on the exterior of buildings, and in landscapes, that have shown it to be an important element that enhances the human response to a building or environment (e.g., Brush & Shafer, 1975; Civco, 1979; Kaplan & Kaplan, 1982; Palmer, 1978; Penning-Roswell, 1979; Shafer, Hamilton, & Schmidt, 1969; Ulrich, 1981; Zube, Pitt &
Anderson, 1975). However, water as a component of interior environments, and its inter-relationship with human behaviors, has received only limited attention.

**Gender Issues**

Like any social institution, gender exhibits both universal features and chronological and cross-cultural variations that affect individual’s lives and their social interactions in major ways. Lorber claims that gender is an institution that establishes patterns of expectations for individuals, orders the social processes of everyday life, is built into the major social organizations of society, such as the economy, ideology, family, and politics, and is also an entity in and of itself (Lorber, 1994).

Most people find it hard to believe that gender is constantly created and recreated out of human interactions and social life. Yet gender, like culture, is a human production that depends on everyone constantly “doing gender” (West and Zimmerman, 1987).

In almost every encounter, human beings produce gender, behaving in the manner they learned as appropriate for their gender status, or resisting or rebelling against these norms. Coser claims that women and men spend much of their time with people of their own gender because of the way they work and their families are organized. This spatial separation of woman and men reinforces gendered different-ness, identity and ways of thinking, and behaving (Coser, 1986).

A recent study conducted by Weisman and Birkby asked women to draw their environmental fantasies in workshops conducted across the United States. The participants were chosen to be diverse in age, lifestyle, experience, and education. After Weisman and Birkby collected hundreds of drawings from the workshops, they began to
notice patterns of shared experiences and common characteristics among the participants. One of the four themes resulting from the study was the importance of contact with nature and natural materials to soothe and stimulate the senses (Weisman, 1992). Furthermore, many studies support the findings that women are: 1) more sensitive than men and 2) looking for relief from environmental stress, especially in public environments (Goffman, 1963, Mozingo, 1989, Gardner, 1989). Also, Ortner claimed, woman’s psyche is seen as closer to nature. The female personality tends to be involved with concrete feelings, things, and people, rather than with abstract entities, and it tends toward personalism and particularism (Ortner, 1996).

**Cultural Issues**

According to Amos Rapoport, a noted authority on the interface between people and built environments, valid generalizations about this relationship must be based on a broad sample, covering a wide variety of situations both in space and time and thus requiring both cross-cultural and historical studies (Rapoport, 1976). Rapoport claims that the built environments are much more than physical objects or economic devices. In order to understand human-environment relationships, one must get beyond material aspects of the environment by using a cross-cultural and historical approach with the nature of cultural environments and their relationships playing a central role (Rapoport, 1980).
Methodology

The purpose of this study was to examine human responses to water features used in interior environments and to determine the extent to which the incorporation of water features may influence people’s preference for those environments. To test this concept, the following hypotheses were developed:

Hypothesis 1: Overall, the preference score for photographic images emphasizing water will be higher than a preference score for photographic images that do not emphasize water features.

Hypothesis 2: The preference score for photographic images emphasizing water will be increase when a water fountain is present in the interior environment.

Hypothesis 3: Female subjects will have a higher preference score for photographic images emphasizing water than male subjects.

Hypothesis 4: Taiwanese subjects will have a higher preference score for photographic images emphasizing water than subjects from the United States.

Sample

To test these hypotheses, data were collected from a sample of 400 college students. A convenience sample of 200 subjects from the Pacific Northwest of the United States of America (100 male and 100 female) was selected from students at an institution of higher education. Another convenience sample of 200 Taiwanese subjects (100 male and 100 female) was also selected from universities in Taiwan. The identity of the subjects was kept confidential and anonymous.
Photographic Images of Interior Environments

Six pairs of photographic images of interior environments were developed with each pair showing a different interior environment. Four out of six pairs consisted of an image of an interior environment with a water feature emphasized and an image of the same interior environment without the water feature emphasized. Each pair of photographic images was duplicated as closely as possible, with the only exception being the emphasis or de-emphasis on a water feature.

A 5th pair of images of the same interior environment without a water feature emphasized and a 6th pair of images of another interior environment with a water feature emphasized was included in the photographic images. The purpose of the 5th and the 6th pair was to prevent subjects from determining the true purpose of the experiment and behaving differently than they would if they were unaware of the purpose of the experiment (demand characteristic).

Because the photographic images were a key part of the study, the content and quality were important. Interior design experts was asked to review the images and recommend 6 pair that, based on their design expertise, they felt were most appropriate for this study. The criteria for these recommendations were: 1) the consistency of contemporary design characteristics, 2) the consistency in scale of the water features, and 3) the consistency in function of the interior environment. The final 6 pair of images recommended for the use in the study by the design experts were developed into 8” x 10” color photographs and laminated.
Room Setting and Viewing Order

A small room (approximately 10’ x 15’) was set up for the subjects to view the six pair of images of interior environments with and without water features emphasized. In room setting W (Water), a small portable water fountain (W8” x D8” x H10”) with water flowing was placed in the room. In room setting NW (No water), the fountain was removed from the room. In other words, the only difference between the two room settings was the presence or absence of the water fountain. In each culture and gender groups, an equal number of subjects was exposed to each room setting.

In addition, to counteract an order effect, the images were presented to the subjects in two different random orders (coded as A and B). One-half of each subject group viewed the images in random order A and the other half viewed the images in random order B. For example, within the 50 American male sample group (S₁) 25 subjects viewed the images in random order A and the other 25 viewed the images in random order B.

The overall design can be summarized in the following table (See Table 1):

<table>
<thead>
<tr>
<th>Room setting with flowing water fountain present (W)</th>
<th>Room setting without flowing water fountain present (NW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US (A) Male (M) S₁ = 50</td>
<td>US (A) Male (M) S₅ = 50</td>
</tr>
<tr>
<td>US (A) Female (F) S₂ = 50</td>
<td>US (A) Female (F) S₆ = 50</td>
</tr>
<tr>
<td>Taiwan (T) Male (M) S₃ = 50</td>
<td>Taiwan (T) Male (M) S₇ = 50</td>
</tr>
<tr>
<td>Taiwan (T) Female (F) S₄ = 50</td>
<td>Taiwan (T) Female (F) S₈ = 50</td>
</tr>
</tbody>
</table>
Photo Questionnaire and Test Administration

The photo questionnaire included the following items (See Appendix B):

1. Brief instructions for completion of the questionnaire.
2. A place for the investigator to mark code information
3. A short demographic profile for the subject to complete; i.e., age, gender, and education.
4. Preference indicators that each subject could mark when viewing the images (See Appendix B).

To ensure that the Taiwanese subjects had a clear understanding, a Chinese version of the photo questionnaire was also developed.

The room setting had two chairs and a table. Each subject was invited into the room and asked to sit down across the table from the investigator. In room setting W, the room also included a fountain with flowing water that was within a three-foot radius of the table. The room setting NW was the same but did not include the water fountain.

The investigator reviewed the instructions with each subject, assured them of confidentiality and anonymity, and then asked them to complete the demographic information. Once that was done, the investigator showed them each a set of the 6 pairs of photographic images with and without water. Each subject was asked to indicate their preference for one of the two images in each pair they were shown. After responding to all 6 pairs of photographic images the subject was thanked and the next participant invited into the room.
Findings and Analysis

The average age of the 400 subjects was 21 years with a range between 18 to 31 years, and 342 (85.5%) were under the age of 23. The dependent variable was the number of preference marks (preference score) made by each subject for images of an interior environment with a water feature emphasized. Since two out of the total of six pairs of photos were used to prevent subjects from determining the true purpose of the experiment, only the data from the 4 applicable pairs were counted. This meant that the range of the preference scores was from 0 to 4. The closer a subject’s score was to 4, the higher their preference for the interior environment with a water feature shown. Table 2 shows the mean preference score and standard deviation for the 8 sample groups.

<table>
<thead>
<tr>
<th>Table 2: Mean Preference Score and Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>With Water Fountain</td>
</tr>
<tr>
<td>Sample Size</td>
</tr>
<tr>
<td>Standard Deviation</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Without Water Fountain</td>
</tr>
<tr>
<td>Sample Size</td>
</tr>
<tr>
<td>Standard Deviation</td>
</tr>
<tr>
<td>Mean</td>
</tr>
</tbody>
</table>

The null hypotheses tested were: 1) In overall, the preference score for the photographic images emphasizing water will be the same as the preference score for the photographic images that do not emphasize water features; 2) the preference score for the photographic images emphasizing water will not change when the water fountain is
present; 3) male and female subjects will have the same preference score to the photographic images emphasizing water; and 4) Taiwanese subjects will have the same preference score to the photographic images emphasizing water as American subjects.

A $t$-test was administered to test the first null hypothesis of indifference (in this study, mean = 2) to determine if there was a significant difference between the subjects’ responses to images of interiors with water and images of interiors without water. The result of this test was a $t$ of 8.69. Since a $t$ over 1.65 is required for rejection of the null hypothesis at the .05 level of significance the hypothesis was rejected. Rejection of the null hypothesis supports the idea that there actually was a significant difference in the subjects’ responses to interiors with and without water features emphasized. In addition to the results of the $t$-test, an examination of the mean scores supports the conclusion that there was a higher preference for the interiors where water was emphasized (See Table 3).

| Table 3: $t$-test of Overall Mean = 2 (null hypothesis of indifference) |
|---------------------------------|------------------|
| $H_0$: $\bar{X} = 2$          |                  |
| $H_1$: $\bar{X} > 2$ or $\bar{X} < 2$ |                  |
| Mean                            | 2.58             |
| Observation                     | 400              |
| $t$                              | 8.69             |
| $t$ Critical one-tail           | 1.65             |

A three-way analysis of variance (ANOVA) was used to analyze the results of both the main effect and the interaction effect of the following three factors: Water (with or without real water flowing in the test room), Culture (U.S. versus Taiwan), and Gender (male versus female). The Three-way ANOVA result table is shown below (See Table 4).
Table 4: Tests of Between-Subjects Effects

Dependent Variable: SCORE

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>228.640a</td>
<td>7</td>
<td>32.663</td>
<td>26.520</td>
<td>.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>2662.560</td>
<td>1</td>
<td>2662.560</td>
<td>2161.813</td>
<td>.000</td>
</tr>
<tr>
<td>CULTURE</td>
<td>222.010</td>
<td>1</td>
<td>222.010</td>
<td>180.257</td>
<td>.000</td>
</tr>
<tr>
<td>WATER</td>
<td>.000</td>
<td>1</td>
<td>.000</td>
<td>.000</td>
<td>1.000</td>
</tr>
<tr>
<td>GENDER</td>
<td>4.840</td>
<td>1</td>
<td>4.840</td>
<td>3.930</td>
<td>.048</td>
</tr>
<tr>
<td>CULTURE * WATER</td>
<td>1.210</td>
<td>1</td>
<td>1.210</td>
<td>.982</td>
<td>.322</td>
</tr>
<tr>
<td>CULTURE * GENDER</td>
<td>.490</td>
<td>1</td>
<td>.490</td>
<td>.398</td>
<td>.529</td>
</tr>
<tr>
<td>WATER * GENDER</td>
<td>.000</td>
<td>1</td>
<td>.000</td>
<td>.000</td>
<td>1.000</td>
</tr>
<tr>
<td>CULTURE * WATER * GENDER</td>
<td>9.000E-02</td>
<td>1</td>
<td>9.000E-02</td>
<td>.073</td>
<td>.787</td>
</tr>
<tr>
<td>Error</td>
<td>482.800</td>
<td>392</td>
<td>1.232</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3374.000</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>711.440</td>
<td>399</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. R Squared = .321 (Adjusted R Squared = .309)

In Table 4 if the F score is above 1, it is significant at .05 level. The “Sig.” column gives the probability (p) value of the F test. The results of this three-way analysis of variance yielded no significant three-way interactions between Culture, Water, and Gender (F = .073, p = .787), and there was no significant two-way interactions between Culture and Water (F = .982, p = .322); Culture and Gender (F = .398, p = .529); Water and Gender (F = .000, p = 1.000).

The main effect for Culture was found to be significant (F = 180.257, p = .000) indicating that the preference score of U.S. subjects and the preference score of Taiwanese subjects tended to be different. The main effect for Gender was also significant (F = 3.930, p < .05) indicating the preference score of female subjects and the preference score of male subjects also tended to be different. In this study, the difference
between the overall mean score of males and the overall mean score of females is only -.22. This indicates that if groups of 100 males and 100 females were compared, the females would prefer a photo emphasizing water a total of 22 more times than the males. This relatively small difference suggests that the substantive importance of this finding may need further examination. Lastly, the main effect when a water fountain was present in the test room had an F value below the .05 level and therefore was not significant (See Table 4).

The means are graphed below with Figure 1 being the room setting with real water flowing and Figure 2 being the room setting without real water flowing.

---

**Figure 1: Effect of Gender on the Preference Score by Culture (with real water flowing in the test room)**

<table>
<thead>
<tr>
<th>Gender</th>
<th>U.S.</th>
<th>Taiwan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>3.32</td>
<td>1.62</td>
</tr>
<tr>
<td>Female</td>
<td>3.44</td>
<td>1.94</td>
</tr>
</tbody>
</table>

**Figure 2: Effect of Gender on the Preference Score by Culture (without real water flowing in the test room)**

<table>
<thead>
<tr>
<th>Gender</th>
<th>U.S.</th>
<th>Taiwan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>3.18</td>
<td>1.76</td>
</tr>
<tr>
<td>Female</td>
<td>3.36</td>
<td>2.02</td>
</tr>
</tbody>
</table>

From Figure 1 and 2 an examination of the main effects of real water flowing in the test room, culture and gender can be done. Contrary to expectations, the presence of real water flowing in the test room did not significantly affect the mean preference scores. Figures 1 and 2 show that the mean preference scores were similar in both room settings (with and without real water flowing.) Also, unexpectedly and contrary to what was
hypothesized, subjects from the United States had higher preference levels than Taiwanese subjects regardless of whether real flowing water was present or not. Lastly, as anticipated, female subjects had higher preference levels than male subjects in all settings regardless of cultural background.

Figures 1 and 2 also show the interaction effect between and among the following variables: 1) real water flowing in the test room and culture; 2) real water flowing in the test room and gender; 3) culture and gender; 4) real water flowing in the test room, culture, and gender. The results of examining these interaction effects show that the cultural difference between Taiwanese subjects and U.S. subjects was greater in the test room with real water flowing than it was in the test room without real water flowing. Unexpectedly, the effect of real water flowing in the test room was positive for American subjects, but negative for Taiwanese subjects.

Figures 1 and 2 also indicate that there was very little interaction between the presence of real water flowing in the test room and gender and there was very little interaction effect between culture and gender. When the interaction effect was examined among the three variables of real water, culture, and gender, there was also very little interaction.
Conclusions

The literature indicates that water is one of the most powerful elements that can be used to enhance the human experience (e.g., Brush & Shafer, 1975; Civco, 1979; Hammitt, 1987; Kaplan & Kaplan, 1982; Palmer, 1978; Penning-Roswell, 1979; Shafer, Hamilton, & Schmidt, 1969; Syme & Nancarrow, 1992; Ulrich, 1981; Yang & Brown, 1992; and Zube, Pitt & Anderson, 1975). For example, Moore claims that water touching our skin is the most personally intimate experience we can have (Moore, 1994). Also, Campbell claims that we want to feel the water in order to complete our experience (Campbell, 1978). In addition, the literature supports the notion that water carries special meanings and associations for people of different ethnic, cultural, and social backgrounds. By the same token, the literature shows that gender, and the way that it is interpreted by different social and cultural groups, is an extremely powerful component of our everyday lives (Gardner, 1989; Goffman, 1963; Mozingo, 1989; Ortner, 1996; Whyte, 1980). As such, it is a powerful design element when used in our built environment.

Overall, the fact that the subjects, regardless of gender or culture, preferred interior images where water features were emphasized supports the literature that suggests people’s experiences are enhanced by the presence of water. Additionally, in keeping with the literature on gender that points out that women are more sensitive to their surrounding environment, the study found that female subjects, again regardless of culture, had a significantly higher preference level for images of interiors with water emphasized than male subjects. These findings can be extrapolated to apply to actual built interior environments.
The Presence of Real Flowing Water

Contrary to expectations, overall the presence of real running water had little to no effect on the subjects’ preferences for an interior image. There are several possible explanations for this result. For instance, perhaps the size of the fountain (water element) in the test room was not sufficiently large enough that people noticed it. Or perhaps, the sound of the water was actually annoying rather than pleasant for most of the subjects. It could also be because the overall design of the water fountain was not integrated well into the whole setting or the design of the fountain itself was not attractive to the subjects.

Gender Differences

In a previous exploratory study that examined the use of existing water features in public spaces (Lin, 1999), contrary to the literature and what was expected, it was found people’s responses to the water features was very low. In addition, there were surprising differences in the way the genders responded to the water features, with male subjects tending to respond to the water feature more frequent than female subjects.

In an attempt to further examine these results, the experimental setting for this study used a small, private and enclosed interior space where the variables could be more controlled. The results of the study counteracted those of the earlier exploratory study, showing that, indeed, female subjects had a higher preference for interior environments with water features than male subjects.

One explanation for these contradictory results is not only that the experimental setting was more controlled, but also, that, as the literature pointed out, females may be more conscious of their safety when in open public environments and therefore less apt to
stop or display their response to water features. In addition, as part of a social order or norm, there is evidence that suggests that women, in general, more tightly define how they behave in public spaces than men (Gardner, 1989; Goffman, 1963; Mozingo, 1989; Ortner, 1996; Whyte, 1980). These studies have concluded that sometimes women display certain attitudes and behavior, yet may shun others.

On the other hand, the literature has also shown that women are more sensitive to their surrounding environments. As stated earlier, the result of the study conducted by Weisman and Birkby shows that women felt it was important to have contact with nature and natural materials that soothe and stimulate the senses (Weisman, 1992). Based on the results of the controlled experiment and the literature on gender and social norms, it can be concluded that although women are actually more sensitive to their surrounding environments, they are less prone to openly respond to water features in public spaces.

Cultural Differences

One unforeseen and interesting result of this controlled study was that American subjects had a significantly higher level of preference to the water than the Taiwanese subjects. In addition, a closer examination reveals that the effect of real water flowing in the test room was positive for American subjects, but negative for Taiwanese subjects. It is suggested that this may be the result of unanticipated variables between the test room in the United States and the test room in Taiwan such as overall design of the room, lighting, layout, background noise and other such variables—even though the size, scale, level of sound, and distance of the flowing water from each subject was tightly controlled in both settings.
Another possible explanation for subjects from the United States’ preferences for water over Taiwanese subjects’, may be related to the recent media focus in the United States on the benefits of *feng shui*, making the incorporation of water features into interior environments very “trendy.” In contrast, *feng shui* is an integral part of the Taiwanese culture. Therefore, it is suggested that since water is an important element of *feng shui*, it is not unusual for water features to be incorporated into Taiwan’s built environment. For Taiwanese people, the use of water elements is just something that is always there. In other words, having water elements in the built environment is normal and not unusual; whereas, for the subjects from the United States it is still new.

The geographical location of the two cultures could be another explanation for subjects from the United States’ preference for water features. The North American continent is so large that it does not allow everyone to be exposed to a big body of water on a daily basis, while Taiwan is a tropical island with the total area of 32,260 sq km, and water is a constant part of daily life.

Lastly, since all of the images used in this study were of contemporary interiors, the low preference level for Taiwanese subjects might indicate a preference for more traditional interiors reflecting the Taiwanese culture. In other words, perhaps the images of interiors with water features shown in the study were not attractive to most of the Taiwanese subjects.

According to an old saying, “Water can either float or sink a boat.” This and many other studies reinforce the idea that water is a powerful element in human experiences. This study suggests that the use of water in interior environments should be carefully
considered by designers and should not assume that all people will respond positively and at the same level to its inclusion.

**Implications for Future Study**

The results of this study emphasize the complex nature of design issues that surround the use of water in an interior environment. It is suggested that a study focusing on the design of interior water features would add to our understanding of these issues. The purpose of such a study would be: 1) to identify the most favorable design for interior water features for specific settings. This would include design aspects such as scale, color and material used. 2) To find out the most favorable water sound, including the level and kind of sound appropriate for specific settings. The results would benefit interior designers and the design community at large, as well as consumers of interior environments, by allowing designers to create interior environments with water features that are based on fact, rather than assumption or intuition.

In addition, it is suggested that a study similar to this one including only Taiwanese subjects could be conducted to further explore the reason for the lower preference level of Taiwanese subjects for water features in interior environments. This study could focus on the incorporation of traditional Taiwanese design elements versus non-traditional, contemporary design elements and water features.
References


CHAPTER THREE

AN EXAMINATION OF CULTURAL AND GENDER PREFERENCES FOR THE
USE OF WATER FEATURES IN INTERIOR ENVIRONMENTS

Abstract:

This study compared the preference scores for water features used in public
interior environments of male and female subjects from the United States and Taiwan. A
sample of 200 college students from universities in the United States and Taiwan
completed a photo questionnaire of images of public interior environments with and
without water features. The average age of the 200 subjects was 21. Based on the
subjects’ responses to the photographic images, a preference score (dependent variable)
was determined by counting the number of preference marks made in the photographs
where water was emphasized. T tests were administered to determine whether there was a
significant relationship between culture and gender responses to water features in public
interior environments.

The results showed no significant differences in preference scores between male
and female subjects. Although, as anticipated, there was a significant cultural difference
in preference scores between U.S. and Taiwanese subjects, the results were contrary to
expectations with U.S. subjects having a higher preference score than Taiwanese
subjects.
Introduction

It is generally accepted that there is a strong and instinctual connection between humans and water (Brown, 1997; Moore, 1994). There are many ways this special significance of water to human kind is expressed. For example, water carries mental images that have special meaning to humans, such as the amniotic fluid from birth to death in the mythical waters of the river Styx (Moore, 1994). Water also carries vital ingredients to sustain life and is essential for growing food (Brown, 1997), maintaining landscaping and gardens, and operating air-conditioning units and heating systems of many buildings.

Culture and gender are intimately related to the way humans respond to water. These responses are complex and dependent upon many variables. The literature points out that cross-cultural studies are necessary to help understand this relationship (Brislin, 1980; Doxiadis, 1976; Rapoport, 1980). This being the case, questions arise about how people from different cultures and of different genders respond to water features designed into our near and built environments.

These questions served as the basis for an exploratory study by Lin where water features in ten public interior spaces were examined (Lin, 1999). The purpose of the study was to examine human responses to water-featured design elements in public interior spaces and to determine the extent to which people modify their behavior as they move through public spaces where water features are included. The results showed surprising differences in the way people of different genders responded to the water features. The results consistently showed that, in the public interior environments examined, male subjects tended to respond to water more frequently than female subjects.
However, the results of the study were inconclusive and served as the inspiration for further examination of the relationships among culture, gender, and water.
Review of Literature

Water and Classical Western and Eastern Cultures

Roman and Renaissance designs were based on the ideas of civilization, wholeness, natural, beauty, harmony, order, and variety of form and content. In Roman antiquity the enjoyment of food and drink was closely linked to nature. For example, in Roman design, frequently, a dining space was placed in the garden as part of a decorative water pavilion as a cool setting for meals during the summer months. Food was placed in little vessels and was floated over water from the server to those being served. The sound and movement of water cascading down water steps or rising from water jets mixing with the gaiety and relaxation of the guests often enhanced Roman meals (Benzel, 1998).

Water, as one of the elements of nature, has also played an important role in Eastern built environments. For example, in China, the earth has commonly been seen as a living organism. Water is respected as an expression of the Tao and points to the path of natural order. Also, in the Chinese philosophy of feng shui, water is one of elements used to enhance spaces. The origins of feng shui are grounded in traditional Chinese philosophies that aim to ensure that all things are in harmony with their surroundings. The words feng shui mean “wind and water” in Chinese and the inclusion of water in interior spaces is one of the methods the feng shui master recommends for building harmony into the environment (Lip, 1994).

The Roles of Women in the Western Cultures of the 19th and 20th Century

In Explorations of Gender (Translated from the French by Arthur Goldhammer), Thebaud writes, “Observing women whose lives have spanned this century, one is struck
by their tragedy and greatness. Buffeted by war, revolution, and dictatorship, they witnessed a major upheaval in relations between the sexes.’ As in the end of the century, today’s feminists are still trying to establish women as subjects of history. Constant tension arises between the need to construct a feminine identity and the further need to demolish the category “women” altogether (Thebaud, 1994).

Edith Wharton lived and wrote about women and the American culture in the late nineteenth century. In her book, *The Age of Innocence and Old New York*, Wharton points out that woman had a role in society. They were the keepers of the moral fabric serving as matriarch in their homes dictating the actions of sons, daughters, and husbands. However, this status disappeared by the first decade of the twentieth century. Their power was replaced by the power of money and money was a realm reserved for men (Chase, 1996).

Women were signifiers of men’s hard-earned wealth and could only flex power through fashion and decoration. The Victorian American woman’s role and purpose was to display the wealth and power of her husband and her family. The American woman was idealized by art and culture. They were an ideal with no power but the decorative (Chase, 1996). The financial boom of the late nineteenth century allowed women new freedom such as the possibility of independence. Feminists started to develop new social institutions to help the independent women (Hayden, 1981).

Thebaud argues, however, “The image of the twentieth century as a time of progress for women, in stark contrast to the Victorian era, is based on a series of clichés” (Thebaud, 1994). He states that the twentieth century—the century of psychology and images—has demonstrated that the Western culture has developed few ways of
representing women. Films, newspapers, magazines and advertising, the model of the housewife, mother, and mother-child relations had created new pressures for women to stay at home. The new woman might seem flashier than the old, but not much has changed.

Thebaud suggests that women still live in the circle that is shaped by the male imagination and masculine social norms. According to Brumberg, more than any other generation, women today must learn to handle the emotional and physical risks that are involved in being sexually expressive in a postmodern, postvirginal world (Brumberg, 1997).

**Gender Differences in the Built Environment**

In *Analyzing Gender in Public Places*, Gardner discusses earlier work by Goffman on public places with regard to women’s experiences. In her study, Gardner focused on illustrating how gender-conscious appraisal is necessary in order to appreciate the character of public places. Gardner concluded that interaction in public places, like other elements of social interaction, cannot be presumed to be gender neutral (Gardner, 1989). This is reinforced by Mozingo’s study *Women and Downtown Open Spaces*, where it was concluded that women have smaller personal space bubbles than men do, women find crowded situations less stressful than men do, and groups of women have smaller territories than groups of men do (Mozingo, 1989).

Further observational studies by Mozingo showed that women moved out of the way of other pedestrians more often than men did and that while men were approached with requests for information, women were most often encroached upon with intrusions
of a sexual nature. As such, it was concluded that men and women perceive and appreciate public open space in different ways. According to Mozingo, the assumption that women use downtown open spaces less frequently because they are not interested is not true. Rather, women are more sensitive to urban annoyances and environmental stresses—noise, crowding, dirt, and traffic—than men are (Mozingo, 1989).

William Whyte in *Street Life Project* found that the most popular public spaces tend to have a higher than average proportion of women. He claims that women are more discriminating than men as to where they will sit, more sensitive to annoyances, and women spend more time casting the various possibilities. Whyte concludes that if a plaza has a lower than average proportion of women, something is wrong. On the other hand, if there is a higher than average proportion of women, the plaza is probably a good one.

Whyte also found that men and women use the plaza in different ways. Men show a tendency to take the front-row seats and they will also like to be the guardians of the gate. In contrast, women tend to favor places slightly secluded. If there are double-sided benches parallel to a street, the inner side will usually have a higher proportion of women and the outer side will be favored by men (Whyte, 1980).

The literature on gender and status shows a close relationship between the built environment and the way gender inequality contributes to spatial arrangements. These gender differences in the built-environment reinforce gender segregation. This means that the spatial arrangement of our built-environment is one of the many factors contributing to gender status differences.
Methodology

This study examined cultural and gender responses to water features used in interior environments and explored whether or not different cultural backgrounds influenced the responses of women versus men. To test this, the following hypotheses were developed:

Hypothesis 1: Within the U.S sample, female subjects will have higher preference score in response to photographic images of interior spaces that emphasize water than male subjects.

Hypothesis 2: Within the Taiwanese sample, female subjects will have higher preference score in response to photographic images of interior spaces that emphasize water than male subjects.

Hypothesis 3: Regardless of gender, Taiwanese subjects will have a higher preference score in response to photographic images of interior spaces that emphasize water than U.S. subjects.

Sample

To test these hypotheses, data were collected from a sample of 200 college students. A convenience sample of 100 subjects from an institution of higher education in the Pacific Northwest of the United States of America (50 male and 50 female) was selected. Another convenience sample of 100 Taiwanese subjects (50 male and 50 female) was also selected from universities in Taiwan. The identity of the subjects was kept confidential and anonymous.
Photographic Images of Interior Environments

Six pairs of photographic images of interior environments were developed with each pair showing a different interior environment. Four out of the six pairs consisted of an image of an interior environment with a water feature emphasized and an image of the same interior environment without the water feature emphasized. Each pair of photographic images was duplicated as closely as possible, with the only exception being to emphasize or de-emphasize a water feature.

The 5th pair consisted of two images of the same interior environment without a water feature emphasized and the 6th pair consisted of two images of another interior environment with a water feature emphasized. The purpose of including the 5th and 6th pair was to prevent subjects from determining the true purpose of the experiment and behaving differently than they would if they were unaware of the purpose of the experiment (demand characteristic).

Because the photographic images were a key part of the study, the content and quality were important. In an attempt to validate the image content and quality, interior design experts were asked to review the images and recommend 6 pair that, based on their design expertise, they felt were most appropriate for this study. The criteria for these recommendations were: 1) the consistency of contemporary design characteristics, 2) the consistency in scale of the water features, and 3) the consistency in function of the interior environment. Once the final six pair of images to be used in the study were identified by the interior design experts, the images were developed into 8” x 10” color photographs and laminated in preparation for showing them to the subjects.
Room Setting and Viewing Order

A small room (approximately 10’ x 15’) was set up for the subjects to view the six pair of images of interior environments with and without water features emphasized. To counteract an order effect, the images were presented to the subjects in two different random orders (coded as A and B). One-half of each subject group viewed the images in random order A and the other half viewed the images in random order B.

The overall design can be summarized in the following table (see Table 5):

<table>
<thead>
<tr>
<th></th>
<th>US (A)</th>
<th>Taiwan (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Order A</td>
<td>S₁ = 25</td>
<td>S₅ = 25</td>
</tr>
<tr>
<td>Order B</td>
<td>S₂ = 25</td>
<td>S₆ = 25</td>
</tr>
</tbody>
</table>

---

Photo Questionnaire and Test Administration

The photo questionnaire included the following items (see Appendix B):

1. Brief instructions for completion of the questionnaire.
2. A place for the investigator to mark code information.
3. A short demographic profile for the subject to complete; i.e., age, gender, and education.
4. Preference indicators that each subject marked when viewing the images.

To ensure that the Taiwanese subjects had a clear understanding, a Chinese version of the photo questionnaire was also developed.
Each subject was invited into the room and asked to sit down across the table from the investigator. The investigator reviewed the instructions with each subject, assured them of confidentiality and anonymity, and then asked them to complete the demographic information. Once that was done the investigator showed them each set of the 6 pairs of photograph images with and without water. Each subject was asked to indicate their preference for one of the two images in each pair they were shown. After responding to all 6 pair of the photographic images the subjects were thanked and the next participant invited into the room.
Analysis and Findings

The average age of the 200 subjects was 21, ranging between 18 and 29 years, with 86.5% under the age of 23. Based on the subjects’ responses to the photographic images, a preference score (dependent variable) was determined by counting the number of preference marks made in the 4 pairs of photographs where water was emphasized. Since two out of the total of six pairs of photos were used to prevent subjects from determining the true purpose of the experiment, only the data from the 4 applicable pairs were counted. This meant that the range of the preference score was from 0 to 4. The closer a subject’s score was to 4, the higher their preference for the interior environment with the water feature shown. Table 6 shows the mean preference score and standard deviation for each sample group.

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Sample Size</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>1.06</td>
<td>0.92</td>
<td>1.35</td>
<td>1.20</td>
</tr>
<tr>
<td>Mean</td>
<td>3.18</td>
<td>3.36</td>
<td>1.76</td>
<td>2.02</td>
</tr>
</tbody>
</table>

The null hypotheses to be tested were: 1) In the US, male and female subjects will have the same preference score to the photographic images emphasizing water; 2) In Taiwan, male and female subjects will have the same preference score to the photographic images emphasizing water; 3) Regardless of gender, Taiwanese subjects will have the same preference score to the photographic images emphasizing water as U.S. subjects.
A $t$-test of gender difference among U.S. subjects was administered to test the first hypothesis with result of a $t$ of .88 (See Table 7). Since a $t$ over 1.68 is required for rejection of the null hypothesis at the .05 level of significance the null hypothesis was not rejected. This indicates that, among U.S. subjects, male and female subjects had no significantly different preference score to the photographic images emphasizing water.

<table>
<thead>
<tr>
<th>Table 7: t-test of Gender Difference among US Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Variance</td>
</tr>
<tr>
<td>Observation</td>
</tr>
<tr>
<td>$t$</td>
</tr>
<tr>
<td>$t$ Critical one-tail</td>
</tr>
</tbody>
</table>

A $t$-test of gender difference among Taiwanese subjects was administered to test the second null hypothesis with resulting $t$ of .97 (See Table 8). Since a $t$ over 1.68 is required for rejection of the null hypothesis at the .05 level of significance the null hypothesis was not rejected. As with the U.S. sample, this indicates that, within Taiwanese subjects, male and female subjects had no significantly different preference score to the photographic images emphasizing water.

<table>
<thead>
<tr>
<th>Table 8: t-test of Gender Difference among Taiwanese Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Variance</td>
</tr>
<tr>
<td>Observation</td>
</tr>
<tr>
<td>$t$</td>
</tr>
<tr>
<td>$t$ Critical one-tail</td>
</tr>
</tbody>
</table>
Lastly, a $t$-test of culture difference between the U.S. and Taiwanese preference scores was administered to test the third null hypothesis with a resulting $t$ of 8.10 (See Table 9). For this test a $t$ over 1.66 is required for rejection of the null hypothesis at the .05 level of significance, therefore the null hypothesis was rejected. This indicates that, regardless of gender, U.S. subjects had a significantly higher preference score than Taiwanese subjects.

<table>
<thead>
<tr>
<th>Table 9: $t$-test of Cultural Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>U.S.</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Variance</td>
</tr>
<tr>
<td>Observation</td>
</tr>
<tr>
<td>$t$</td>
</tr>
<tr>
<td>$t$ Critical one-tail</td>
</tr>
</tbody>
</table>

Conclusions

Water has been used as a design element in a multitude of ways throughout the ages and, according to the literature, water is an influential element that enhances the human experience. Water also represents a complexity and interweaving of function and symbolism to people of different cultures and carries special meanings and associations for people of different ethnic, cultural, and social backgrounds. As such, it is a powerful design element when used in our built environment. By the same token, gender, and the way in which it is interpreted by different social and cultural groups, is an extremely powerful component of our everyday lives (Gardner, 1989; Goffman, 1963; Mozingo, 1989; Ortner, 1996; Whyte, 1980).

Cultural Differences

The results of this study show that U.S. subjects had a significantly higher level of preference to the water than the Taiwanese subjects. This result was contrary to what was expected. Since *feng shui* has played such an important role in the Taiwan culture for centuries, it was anticipated that this would be reflected in a higher preference score for the use of water in interior environments in Taiwan than in the U.S. This assumption was supported by the literature on meaning and symbolism that indicates water has special meaning for various cultures (Campbell, 1978; Brown, 1997; Douglas, 1970; Fitzsimmons & Salama, 1977; Moore, 1994; Spear, 1995; Syme & Nancarrow, 1992; Yang & Brown, 1992).

It is postulated that this unanticipated result may be explained by the recent media’s focus on *feng shui* as a positive influence on lifestyle in the U.S. For example, in
recent years, small-scale water fountains have become ubiquitous on the U.S. marketplace and consumers have been bombarded with advertisements and media coverage about the positive benefits of including water elements in interior environments.

Over the last 50 years, social scientists have developed various theories of how mass-media can affect human behavior. For example, the Cultivation Theory of mass media, proposed by George Gerbner, specifies that repeated and intense exposure to distinctive definitions of "reality" in mass-media messages lead to the perception of that "reality" as normal. The result is a social legitimization of the "reality" depicted in the mass media, which can affect behavior (Gerbner 1973 & 1977).

Also, the Social Learning Theory, developed by Albert Bandura, specifies that mass-media messages give audience members an opportunity to identify with attractive characters who demonstrate behavior, engage emotions, and allow mental rehearsal and modeling of new behavior (Bandura 1977 & 1986). The results of this study support the literature on media and its impact.

Another explanation for this result may lie in the fact that in the Taiwan culture, feng shui has been practiced for generations. Since water is a very important element in feng shui, water elements have played a prominent role in the Taiwan culture for centuries. As such, examples of the incorporation of water elements into interior environments are plentiful. It is not difficult to find examples of the use of water in interior environments in Taiwan ranging from ancient to contemporary applications. As a result, water elements are more common and not unusual in Taiwan. In other words, water elements may not have been seen as special to the Taiwanese subjects, but were identified as such by the U.S. subjects.
This explanation is strengthened by the fact that Taiwan is a tropical island and water is a constant part of daily life. Therefore, Taiwanese subjects are surrounded by water and have access to it every day. Contrarily, the U.S. subjects were drawn from an inland geographic location and were therefore not routinely exposed to a sizeable body of water. This proximity and exposure of the Taiwan culture to water and water elements may have contributed to a lower preference score.

One should also consider the value placed on interior environments that express a more traditional interior design approach in Taiwan as opposed to a more contemporary interpretation. All the images used in the study were contemporary applications. It is suggested, therefore, that the strength of the cultural context of the Taiwanese subjects may have been stronger than the cultural context of the U.S. subjects and that the Taiwanese preference score may reflect a preference for more traditional than contemporary interior design interpretations. In other words, since the images used in this study were all contemporary interior design interpretations, the lower preference score of Taiwanese subjects may have been influenced by an overall lower preference for contemporary interior design interpretations in general.

Lastly, it is possible that the procedure used to select the photographic images of interior environments with and without water may have needed tighter control and, because of the absence of such control, resulted in an unanticipated cultural difference. It is suggested that, if the study were repeated, the random selection of the interior images with and without water features would strengthen the cross-cultural comparison and the validity of results.
Gender Differences

This study was undertaken in an attempt to gain a better understanding of the results of a previous exploratory study on the use of water features in public interior environments. In the earlier observational study conducted by Lin, people’s responses to a major water feature in 10 public interior spaces were studied. The results consistently showed that male subjects tended to respond to water features more frequently than female subjects (Lin, 1999). However, the results of the current study showed no significant differences between the genders in their preference scores. In addition, the results showed that male and female subjects had no significant differences in their preference scores regardless of cultural background; i.e., U.S. versus Taiwan.

It is suggested that the results of the current study are more valid and better reflect the true nature of gender responses to the use of water elements in interior spaces. The original study was exploratory and therefore many variables were not controlled. In contrast, the current study controlled more tightly for extraneous variables that might impact the results. For example, the experiment was conducted in controlled environments that were duplicated at both the U.S. and Taiwan sites, while in the earlier experiment observations were made in various public spaces with no attempt to control variables. Therefore, although not able to generalize beyond this sample, it can be said with some confidence that there is no significant difference between gender responses to water elements in interior spaces regardless of cultural background.
Implications for Future Study

As stated earlier, since no one culture contains all environmental conditions that can affect human behavior and no one country contains all possible types of humanly made changes to the physical environment, cross-cultural studies are necessary for the complete development of theories in environmental research (Brislin, 1980). It is suggested therefore that duplication of this study with more tightly controlled selection of photographic images and conducted among people of various cultural and ethnic backgrounds beyond Taiwan and the U.S. would add to our understanding and interpretation of appropriate applications of water features in interior environments. In addition, further exploration and development of a study that addresses specifically the influence on, and longevity of, popular media on preferences for water features in interior environments is suggested.

Another study of interest would be to test Downing’s “image bank” argument when applied to interior environments that incorporate water features. As described by Downing, an image bank is defined as the accumulation of a designer’s mental imagery of memorable place or experience. Downing argues designers can use these “known” experiences (image bank) to understand the “unknown” (a design problem) (Downing, 1992). For example, a comparison could be made between a designer’s image bank and those of U.S. and Taiwanese subjects relative to interior environments that incorporate major water features.
References


London: VCH Publishers (UK) Ltd.


CHAPTER FOUR

SUMMARY

In most human civilizations, villages and cities were first developed near sources of water with trade and exploration was dependent upon waterways. For example, some of the earliest known civilizations, such as, Ur, Nippur, Babylon, Uruk, and Sumer started in the flat plain between the two rivers. The Nile connected all Egyptian cities, pyramids, villages, temples, and towns into one civilization (Symmes, 1998).

Water, then, has continually shaped our world, and people have constantly tried to control it to fulfill their needs and desires. From the beginning of civilization into contemporary times, it is evident that most major cities in the world were first settled along rivers, waterways, and major bodies of water; i.e., Paris, France; Amsterdam, The Netherlands; Beijing and Suzhou, China; New York City and Pittsburgh, U.S.; and Rome and Venice, Italy (Moore, 1994).

Throughout the ages, water has served humankind and has been used to enhance life’s journey in a multitude of ways—in religion, literature, art, and culture. The literature supports the notion that water is one of the most powerful elements that can be used to enhance the human experience. (e.g., Brush & Shafer, 1975; Civco, 1979; Hammitt, 1987; Kaplan & Kaplan, 1982; Palmer, 1978; Penning-Roswell, 1979; Shafer, Hamilton, & Schmidt, 1969; Syme & Nancarrow, 1992; Ulrich, 1981; Yang & Brown, 1992; and Zube, Pitt & Anderson, 1975). The connections between water and humans run deep and strong, and those connections weave human life and nature together.
When water is included in our designed environments, we cannot ignore the roles that history and symbolism play in the connections among water, people, and culture. Rapoport claims, “Any consideration of built environments must take into account not only the ‘hardware’ but also people, their activities, wants, needs, values, life-styles and other aspects of culture” (Rapoport, 1994). Yet gender, like culture, is also a major human production. Lorber states, as a social institution, gender is one of the major ways that human beings organize their lives. It is an institution that establishes patterns of expectations for individuals, orders the social processes of everyday life, and is built into the major social organizations of society (Lorber, 1994).

Kaplan states, “Designers and planners are concerned with what visual cues, patterns, and configurations that aid people in their perception and cognition of, and functioning in, environments (Kaplan and Kaplan, 1978). Through this study a better appreciation and understanding of the relationship between water features in interior environments and people, gender, and culture was gained and this knowledge can help guide future design decisions for the use of water in interior environments.

The results presented in the article entitled, Human Responses to Water Elements in Interior Environments, show that the subjects, regardless of gender or culture, preferred interior images where water features were emphasized. This supports the literature that suggests people’s experiences are enhanced by the presence of water. Other key findings presented in this article argue that female subjects have a higher preference to water features in interior environments than male subjects; and that subjects from the United States have a higher preference to water features in interior environments than Taiwanese subjects.
The results of the study presented in the article entitled, *An Examination of Cultural and Gender Preferences for the Use of Water Features in Interior Environments*, show that, when using a smaller sample, no significant differences in preference scores were found between genders. Although this appears to be in conflict with the results presented in the first article, it should be noted that although a significant difference in gender preference scores was noted in the first article when using a larger sample, there was a relatively small difference between the means of males and females. This suggests that, although significant, the results shown in the first article were not extremely strong. This further suggests, more importantly, that there were likely behavioral differences in play that were not measurable and deserve further study.

The results of this study have special significance to the professional design community at large and, in particular, to the interior design practitioner community. The study points out the need for careful consideration of the planned use and function of an interior space before a water feature is incorporated. The study further strengthens the idea that before incorporating a major water feature into a designed environment, creators of that space must carefully assess such things as: 1) who are the planned occupants of the designed space, 2) what genders will predominantly interact with the designed space, and what is the cultural background of the users of the designed space. Since water features are expensive and hard to maintain, the use of water in interior environments should be carefully considered by designers and not based on the assumption that all people will respond positively and at the same level to its inclusion. In some instances, a major water feature may not be the best solution when a less expensive and lower maintenance solution would work better.
References


APPENDIX A

VERBAL CONSENT SCRIPT
Verbal Consent Script

Hello, my name is Gwo-Fang Lin, and I am a graduate student with The Individual Interdisciplinary Doctoral Program at Washington State University. I am collecting data for my research project on interior design elements, and I’d like to ask you for your help by answering 6 photo questions. Your participation in this survey should take about 3 minutes.

These data will be strictly confidential and I will not record your name. Also, your participation is completely voluntary. You are free to not answer any questions you may find objectionable, and may withdraw from the study at any time. This research has been reviewed and approved by the Institutional Review Board at WSU. If you have any questions or concerns about this research project, you can contact the WSU IRB at (509) 335-9661.

Are there any questions about my study that I can answer for you at this time?
APPENDIX B

PHOTO QUESTIONNAIRE
Photo Questionnaire

Please complete the short demographic profile on the left side first. Then, I will show you 6 pair of photographs of interior spaces, one pair at a time. After viewing each pair, you will have 10 seconds to mark the one space you prefer. It will take approximately 1 minute to finish all questions.

____ Freshman
____ Sophomore
____ Junior
____ Senior
____ Graduate

Age: ______
Gender: ______    ______
        Male     Female

Pair 1: ______    ______
        A        B

Pair 2: ______    ______
        A        B

Pair 3: ______    ______
        A        B

Pair 4: ______    ______
        A        B

Pair 5: ______    ______
        A        B

Pair 6: ______    ______
        A        B