

## 論文の内容の要旨

### 論文題目

## Obscured Boundaries: A Case Study on the Design Principles Used in the “Bosen” Tea Room of Koho-an Temple

### 曖昧な境界：孤篷庵「忘筌の間」におけるデザイン・プリンシプル

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This dissertation, which contributes to the field of architecture design, examines one of Japan's most famous tea rooms designed by the tea master Kobori Enshu. The tea room named “Bosen”, can be found on the west side of Koho-an temple in Kyoto. Upon setting out on a survey of over 100 temples, shrines, tea houses, tea rooms, and villages, the tea room selected for this study showed unique characteristics and performance in the interaction and adaptation of this space under different conditions around the year. The tea room also showed a mastery of the creation of boundaries, used in its designed to improve the atmosphere of the space. By looking at the designed principles used in this tea room, it is the intention of this research to how these principles can be used in urban spaces to improve the quality spaces.

*“A Japanese room might be likened to an inkwash painting, the paper-paneled shoji being the expanse where the ink is the thinnest, and the alcove where it is darkest. Whenever I see the alcove of a tastefully built Japanese room, I marvel at our comprehension of the secrets of shadows, our sensitive use of shadows and light...And even we as children would feel an inexpressible chill as we peered into the depths of an alcove to which the sunlight had never penetrated. Where lays the key to this mystery? Ultimately it is the magic of shadows.”*

*Junichiro Tanizaki*

The writings of *Junichiro Tanizaki*<sup>1</sup>, in his book “In Praise of Shadows” clearly define the beauty and mystery found in traditional Japanese architecture. This understanding of light and shadow, and the mystery of traditional spaces contributed to my involvement in the study of Japanese architecture. Upon studying traditional Japanese spaces, one begins to see a clear understanding and control of light and shadow. Traditional Japanese architecture also displays an immense understanding and control of boundaries. In Japanese, boundaries are known as *Kyokai*, this idea of framing and adding limits to space is a design principle deeply rooted in Japanese culture, and it is an important tool in the articulation of spaces. Over time architects and tea masters were able to refine design techniques to create spaces full of mystery and beauty. Japanese people also regard nature with the highest respect, further influencing their deep connection to it. A building is never seen as one individual space, but as something part of the

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<sup>1</sup> Junichiro Tanizaki was a Japanese author, and one of the major writers of modern Japanese literature. In the book “In Praise of Shadows” Tanizaki discusses the aesthetics of traditional Japanese architecture in relation to his personal experience in the struggle between Western influences on Japanese culture.

surroundings. For this reason, traditional spaces are always in constant connection with nature, and nature in contact with the building. Both interior and exterior work as one, and through this they are able to complement each other. From the building one is able to enjoy the beauty of nature. Furthermore, the precise design of the building adds limits to the exterior space, framing it like a painting, a natural painting which is always changing and expressing the beauty of every season. On the other hand, the exterior space is able to mix with the building through the use of natural materials, many of which are taken from the actual site. Also, the openness of the building reduces the strong boundaries between interior and exterior, allowing for both to mix through obscured boundaries.

Although the size of traditional spaces can vary, from small tea rooms to large tea houses, one element they all share is their flexibility to adapt to changing conditions. Through the use of sliding doors, each space can change to become bigger or smaller. These moveable partitions further provide flexibility in the control of exterior views. Every element in the space has a design purpose, elements will not be added just for show, instead every piece in the space is there for a reason. The use of natural materials allows the building to link to the exterior, establishing similarities in textures and colors found locally. Most important, the beauty of light and shadow talked about by *Junichiro Tanizaki* becomes a result of the precise placement of openings and paper screens. In traditional Japanese architecture the variety of these paper screens is immense. They can be used as sliding doors, windows, or as shading devices. Through these devices, the mystery and articulation of a Japanese space is created. Including paper screens, the overall design of a space is made to shield the building from direct light, resulting in a dark space. This is mainly a result of Japan's harsh summer weather, where it can get extremely hot and humid. In the event direct light pierces the interior space, paper screens work as shading devices, diluting direct light into a more soft ambient light. If direct light was allowed to enter the space it would create a strong boundary between light and shadow, but if the light is filtered by paper screens, this light can be distributed to the entire space, reducing the boundaries between light and dark.

After completing the survey, the spaces which showed the most awareness and adaptability to their environment were tea rooms. These small rooms for enjoying tea provided the closest link to *Tanizaki's* writings into the mystery of light and shadow in a Japanese space. At the same time, the size allowed the inhabitants to take full advantage of the space by becoming a part of the environment. From this point forward, the research focused on tea rooms designed by famous tea masters, many times spending an entire day inside the tea room. It was during this period that my professor showed me a picture of the *Bosen* tea room designed by the tea master *Kobori Enshu*. By only looking at the space it did not appear so different from other tea rooms; instead this room was set apart by the design and use of a paper screen. Unlike other paper screens which work as sliding doors, this one was placed on the upper portion of the wall, leaving the bottom half open. The applications of this screen are also unique among other screens, as it is able to adapt to different conditions. The screen can work as a shading device, entrance, frame to the garden, to obscure the exterior space, and to provide ambient illumination. Aside from this, the overall design of this tea room is meant to evoke an atmosphere of being near water. After learning this, it became clear that the *Bosen* tea room would become the focus of this thesis, but, unfortunately, it proved to be quite difficult to visit this space as the temple is highly guarded and visitors are rarely let in. It wasn't until providing many recommendation letters that entrance became possible. While seating in the *Bosen* tea room, I could finally experience the last tea room designed by *Kobori Enshu*, a tea room he designed for himself. During this visit the monk further explained the important uses of the paper screen, especially how it can help to create an atmosphere of being near water by obscuring part of the exterior scenery. The monk also mentioned that at certain times of the year water ripples can be seen on the ceiling of the tea room, although they are very rare. The water ripples are created by a wash basin placed in front of the veranda. Typically, it is used by guests to wash their hands before entering the tea room, but if sunlight hits it, it will reflect water ripples inside the space. In order to verify his story, the 3d model will also be used to simulate the creation of water ripples. Especially to determine how the water ripples might look on the ceiling of the space and how they can be perceived from the seating position of

the tea master. Also, the 3d model will make it possible to determine when is the best time to see this effect, and the conditions under which it occurs.

Overall, this thesis will focus on a single case study of the Bosen tea room. Here its paper screen will be simulated and analyzed under different conditions. The lighting conditions from sunrise to sunset will also be look at, in order to understand how variations in the paper screens effect interior illumination. Next, the creation of water ripples will be simulated to determine when they occur and under what conditions. Finally, direct and indirect light reading in the tea room will be compared to variations in shading devices, establishing a detail picture of how the paper screens effects the interior illumination and at the same time provides flexibility for the space.

By only looking at the Bosen tea room it does not appear so different from other tea rooms; instead this room is set apart by the design of a single paper screen. Unlike other paper screens which work as sliding doors, this one was placed on the upper portion of the wall, leaving the bottom half open. The applications of this screen are also unique among other screens, as it is able to adapt to different conditions. The screen can work as a shading device, entrance, frame to the garden, to obscure the exterior space, and to provide ambient illumination. Aside from this, the overall design of this tea room is meant to evoke an atmosphere of being near water. And so, through the creation of water ripples by a wash basin placed in front of the veranda, the tea room is able to create a connection to water. As a whole, the tea room is given increased flexibility through the use of its paper screen. This flexibility created by a single element will be analyzed under different conditions using 3d simulations. Through the use of a 3d model, variations in the placement and layering of paper screens will be tested, to see the effects on the interior space. Furthermore, by using a light meter in the 3d model, it will make it possible to measure the amount of light throughout the day. This will make it possible to compare the results of each variation in the paper screen, and determine changes in the interior space. Next, in order to understand the creation of water ripples inside the space, the 3d model will also be used to simulate the creation of this effect. Especially to determined how the water ripples might look on the ceiling of the space and how they can be perceived from the seating position of the tea master. Also, the 3d model will make it possible to determine when is the best time to see this effect, and the conditions under which it occurs. All these elements will be analyzed from sunrise to sunset and during spring, summer, autumn, and winter. At the same time, since boundaries play a constant role in the design of the space, each type of boundary used will be studied in detail to determine how it works. Finally, by understanding the use of boundaries in this tea room, it is the intention of this research to demonstrate how the use of boundaries can improve urban space around the world.

## **Organization of Thesis**

Overall this dissertation is organized in three parts, Framework, Case Studies, and Conclusions. Chapters one, two, three, and four provide all the background and methodology necessary for the understanding of selected research. Next, chapters five and six provide a detailed case study on the use of shading device and creation of water ripples on the Bosen tea room, made possible through a 3d simulation of the tea room. Finally, chapter seven and eight will show conclusions and results gathered from the case studies and possible applications in urban spaces.

## **Chapter 1: Introduction**

Through a research expanding the survey of over 120 different temples, shrines and tea rooms in different parts of Japan, it has provide a clear understanding of the importance of traditional design in improving the quality of spaces. Also, to the importance given to every element in a space, every piece has a purpose, contributing to the overall atmosphere of the space. In order to better understand these ideas, this research focuses on a case study of a single traditional space, one which shows an expanded awareness and articulation of the environment. Through the use of 3d simulation software, the space will be recreated and analyzed from all angles, in order to understand how every component works. However,

before determining which space to study, different locations were analyzed during four seasons, spring, summer, autumn, and winter. By observing each space during multiple seasons, it made it possible to study the adaptability of these spaces to changing conditions. These trips provided the opportunity to see the beauty of traditional architecture and to further understand the design process. The number of locations visited also made it possible to determine similarities in multiple locations, many of which use similar paper screens, garden views, and arrangement of interior spaces.

## **Chapter 2: Methodology**

In order to achieve the most precise result from the analysis of the Bosen tea room, a detailed 3d model of the tea room had to be created, allowing for different conditions to be studied, as well as experimenting with conditions not possible in the actual location. Through the creation of a detail 3d model of the Bosen tea room, it is the aim of this dissertation to study the light conditions in the interior space at different times and seasons. The 3d model will also be used to test the validity of several stories told by the temple monk and a fellow researcher, regarding the reflection of water ripples on the ceiling of the tea room. Next, the 3d model will serve to create various animations of the tea room from sunrise to sunset, and during all four seasons. The animations will allow a better understanding of the movement of direct light in the space, as well as showing other people a view of the highly guarded temple.

## **Chapter 3: Background**

In a Traditional Japanese room simplicity dominates the interior space, allowing the room to take advantage and highlight the beauty of nature. Whether through different seasons or from sunrise to sunset, the beauty of a Japanese tea room will constantly change. With each visit to the same space, each person will have a different appreciation of the space. The simplicity of the space is enhanced by the beauty of natural light and the positioning of shading devices, which give boundaries to the exterior, capturing a perfect view. Following this, this chapter continues with a detailed description of the Bosen tea room, including the ideas behind its design.

## **Chapter 4: Description of the Nine Shading Variations which will be tested**

Traditional Japanese architecture is renowned for the way it's able to adapt to changing conditions. From summer to winter interior spaces can change to enhance air circulation during summer, while in winter the addition of paper screens provide extra warmth while still providing much needed light. In case a bigger room is needed, sliding doors can be removed to combine multiple rooms into one space. During the summer months when heat and humidity are a big problem, sliding doors around the perimeter of the building can be removed; creating much needed air circulation to the interior. In the winter months all the shoji sliding doors can be closed to provide extra insulation. At the same time sliding doors can be used to emphasize certain spaces in the exterior, by controlling how much of the door is open, one can create a frame to the exterior. In most cases, this is used to give special attention to an important view of a mountain or garden, framing the view as a picture. Overall Japanese architecture provides full control of its space, adapting and changing as needed throughout the year. For this reason, nine variations which are possible in the tea room will be described, explaining under which conditions they may or not be used.

## **Chapter 5: Analysis of Variations in Shading Devices during the Year**

In this section, the nine shading variations will be tested during spring, summer, autumn and winter. For each case the 3d model will be used to simulate actual site and atmospheric conditions found around Koho-an temple. The 3d model will then make use of simulated cameras which being matched to those of a real digital camera, including the use of a 24mm lens used in my research. Next, the camera settings have been maintained for every rendering created from sunset to sunrise. Overall 16 renderings have been created for each simulation. As the sunrise and sunset times will vary throughout the year, all the 16

renderings have been maintained at the same time, starting at 06:00am and finishing at 18:00pm. In the period from 06:00am to 15:00pm each rendering has been taken at one hour increments, since there is little penetration of direct light on the interior space. After 15:00pm the increments are reduced to half an hour, as during this time direct light starts to enter and move fast in the interior space. Overall, this will permit a detail analysis of the movement and quality of light during the day and year.

## **Chapter 6: Analysis on the Creation of Water Ripple in the Bosen Tea Rom**

The overall design of the Bosen tea room is meant to evoke the feeling of being on a boat. Since *Kobori Enshu* grew up near Lake Biwa, he wanted to recreate the essence of this space in Kyoto. In order to accomplish this he incorporated many small design hints in the construction of the Bosen tea room. Alone, these hints would mean nothing, but if seen together one can start to build a picture of the ambient *Enshu* wanted to recreate, that being of a tea house on the lake. For this reason it is the intention of this chapter to analyze and simulate the effects of caustics on the Bosen tea room around the year. The conditions during four seasons will be recreated in 3d to determine the best conditions for caustics to be created, and what times of the day offer the best possibility to see them. Like the previous chapter, simulated renderings will be created from sunrise to sunset to document the progression of caustics throughout the day. In order to further understand the effects of caustics, four animations will be created, showing the progression of caustics during four seasons.

## **Chapter 7: Analysis on the Creation of Boundaries inside the Bosen Tea Room**

Traditional Japanese architecture is full of boundaries, some very bold and direct, while others are softer or even hidden from sight. Some of these boundaries can be easily pointed out as boundaries, even by people of other cultures. However, others require people to share similar knowledge of cultural background to define them as boundaries. The boundaries also don't have to be fixed, some can change with time. Although some of these boundaries are used for showing certain areas, as the case with framing a picture of the garden, others have a more religious quality, and serve as purification before entering a certain space. Or they may even define a space as pure; a space which people cannot enter, almost like an altar. Overall, this chapter will describe all the boundaries found in the Bosen tea room divided in three categories, visual boundaries, temporary boundaries, and purifying boundaries.

## **Chapter 8: Conclusions**

In conclusion, the significance of this thesis is to reveal the special characteristics which are empirically depicted using 3d simulation method for static viewing. Through the application of some of the design principals used in the Bosen tea room, it will have a positive impact on urban spaces who wish to reconnect to their natural environment while providing an improved atmosphere and feeling of a bigger space. The applications would be extensive, as different individuals and companies would be able to use this research to improve the creation of new urban spaces, creating a better environment for everyone, and at the same time creating a space where one can relax while being in the city. The final space might not resemble a traditional space; instead it will make use of traditional principles to create a space with the essences to traditional design. The research would further impact and benefit Western architecture by providing a guideline for creating improved spaces in cities around the world. By looking at traditional tea rooms, it shows us that small spaces don't have to feel small and through the understanding of the creation of boundaries these spaces can be transformed into a world of relaxation, even to escape the chaotic life of urban space. Understandings of the creation of spaces which relate and incorporate their surroundings will also reinforced peoples connection to a space, making them feel part of something. Even if a space is lacking a desired natural view, the Bosen tea room has demonstrated that this is not an obstacle, by following some of the principals of traditional design; it can lead to the creation of a space having the essence of the desired landscape. A person's imagination can go a long way in reshaping a space by simply providing hints and through the precise placement of boundaries.